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SCIENCE

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EXPERIMENTUM PERICULOSUM; JUDICIUM DIFFICILE[1]

IT is probably forgotten that the two of us who are to conclude the exercises of this auspicious day have previously been called upon to give some public statement of Yale's relation to medicine—Dr. Welch fully in 1901 as part of the Bicentennial Celebration of the founding of the college, and I briefly fifteen years later for the "Book of the Pageant" celebrating the move to New Haven.

If not forgotten, it may be that we are now asked to take part in the dedication of these magnificent laboratories for a particular reason. Any one, who might happen upon the printed statements, will find that, up to the time of those celebrations, there had been more to say of the contributions to medicine made by Yale graduates in general than of any great influence on our profession, exerted by Yale herself through the agency of this, in point of years, her oldest professional school. The appeal with which Dr. Welch closed his address, namely, that the next Jubilee might find medicine holding here the high position to which it is entitled, has been answered sooner than the most optimistic among us could have expected.

Though the act, passed by the General Assembly in 1810, creating a "Medical Institution" for the college, was the first step toward Yale's development into a university, for the next hundred years the department was allowed to shift largely for itself. The collegians, whose life centered round "the Fence" and the old "Brick Row," hardly knew of its existence; those who did apologized for it; a few warmly advocated the abandonment of a local department which by no possibility could ever compete with the schools of a metropolitan city near at hand where hospitals and clinical facilities existed in abundance. There was a time, indeed, when this recommendation, seriously proposed by certain influential alumni, came dangerously near being followed.

In the want of a hospital under university control, wherein the professors of the school might do their clinical teaching, lay the crux of the situation. The essential importance of such an arrangement was first made clear by certain happenings in Baltimore, where a short fifty years ago a wealthy merchant had left what for the time was a princely sum, partly to found a university, partly to build a hospital. And Johns

[1] An address at the dedication of the Sterling Hall of Medicine, Yale University, February 23, 1925.

Hopkins was shrewd enough to appreciate what so often has been pointed out, that a university and a hospital are likely to be the two most enduring of human institutions. Political boundaries change; forms of government undergo revolution; but the people remain and there will always be those in search of education, always the sick and maimed in need of care.

Before that time, hospitals almost without exception were independent foundations whose controlling boards, though permitting students to attend lectures in an amphitheater, looked askance upon their admission to the wards. But the example set in Baltimore in the 90's soon made itself widely felt, and those who had been drawn there for periods of study became inoculated with the idea of a university teaching-hospital, in which students could get their practical training actually at the bedside, and carried this principle to the ends of the country. Two of them, to whom I would like to pay passing tribute, were by an earthquake dislodged from the university positions they were holding and brought here at a time when this school was in the doldrums; and to the patience and persistence of George Blumer and Joseph Marshall Flint, during the trying decade which followed, we may well ascribe the rescue of the Yale Medical School through the establishment of a definite university alliance with the General Hospital Society of Connecticut.

And now in the short span since the war, a truly amazing renaissance has taken place, culminating in the erection of this Sterling Hall of Medicine and justifying all the efforts of the previous century on the part of the faithful, much neglected and nigh forgotten teachers who, under financial difficulties unbelievable, maintained a high standard and held the school together from the time of its foundation till the dawn of this new era. It is to the men of the older faculties—to men like William Henry Carmalt, happily here with us, and Herbert Eugene Smith, for twenty-five years professor of chemistry and dean of the school, that we must give thanks for making this day possible. And I am glad to learn that a message to this effect has been sent to Dean Smith on his distant ranch at Los Gatos, California, so that he may rejoice with the rest of us who, holding the welfare and reputation of Yale at heart, have long felt that medicine should be strongly represented among her faculties.

We are living in an amazing epoch, too near for us to get other than a blurred picture of its full significance. Probably all people, from the beginning, have regarded their particular time as the most remarkable in history. Yet, in principle, so far as the profession of medicine is concerned, what, four centuries before Christ was so cogently expressed in a familiar aphorism remains unbettered. We can not too often hear the lines repeated:

> LIFE IS SHORT AND THE ART LONG; THE OCCASION FLEETING; EXPERIENCE FALLACIOUS, AND JUDGMENT DIFFICULT. THE PHYSICIAN MUST NOT ONLY BE PREPARED TO DO WHAT IS RIGHT HIMSELF, BUT ALSO TO MAKE THE PATIENTS, THE ATTENDANTS, AND EXTERNALS COOPERATE.

Experience is no less fallacious to-day: judgment no less difficult. The mental processes of that peculiar animal man, our sometime patient, are the same now as then. He has strange and unaccountable reactions. He conducts a great war to end all wars and constructs a peace to end all peace. Incidentally, it was learned that it is not the pen but propaganda and publicity that are mightier than the sword. Advertising, which is but propaganda undisguised, is anathema to the ethical code of the physician whose standards, if he is to justify the trust humanity has long placed in him, should be on a plane above business. Yet one of our universities proposes to elevate business to the rank of a profession. Whether this example will improve the code of business or lower that of the learned professions should they, as would be consistent, come to regard advertising along with other business methods as justifiable, remains to be seen. The temptation is great; it is not unresisted by highly respected institutions, some of which actually employ publicity agents; but it is lamentable when a great medical school takes to horn-blowing and sets thereby a bad example to other schools and the profession individually.

It may be said of course that the people at large do not evaluate for themselves. While our profession studiously employs the methods of science to catch the truth in medicine, new sects arise and the therapeutic doctrines of the Abramite spread over the land. While Saurian eggs are being discovered in Manchuria, our state legislatures introduce, even pass, bills prohibiting the teaching of evolution. While electro-physicists are perfecting the miracle of wireless communication, the lecture halls are filled with educated persons whose curiosity is more aroused by a discussion of ectoplasm. While the astronomer with near exactitude announces a solar eclipse, the Seventh Day Adventists with no less assurance predict the end of the world. While sanitarians are conquering pestilence, the antivivisection and antivaccination societies receive large gifts wherewith to oppose the very measures which make such things possible. While nations are stewing in their post-bellum troubles, jazz, the "movie" and the *thé dansant* engage the thoughts of the masses. The only common ground on which the interests of all appear to meet is the crossword puzzle. What we need perhaps as much

as anything in our institutions of higher learning is the scientific study of human reactions and behavior.

One might suppose that faith could be pinned on the time-honored professions as a steadying influence. And well it may, though "Modernism" temporarily rocks the church and the law seems more interested in technicalities than justice. Medicine, too, is undergoing severe criticism for its imperfections, though no one of us doubts that it still carries high the banner of service; that it strives to bring the day nearer when there will be less ill health in the world and consequently less for the doctor to do.

You energetic young men who happily comprise the faculty of this newborn institution will have to decide for yourselves, without help from outside sources, just what is the form of service that can best be rendered the profession, the community and mankind through the medium of this new and perfect instrument placed in your hands. It opens wide the door of opportunity and there are many things you will wish to accomplish. For their fulfillment not alone imagination and industry are needed but in addition what is known as the spirit of team-play, unselfish loyalty to one another and to your common purposes and objects.

There are certain things you will set out to do in the tradition of your predecessors in this school. You will in the first place not fail to keep in sympathetic contact with the profession of the state as represented by the venerable Connecticut Medical Association whose ranks you should continue to recruit by men better equipped than ever before to make the doctor perhaps the most valued member of his community. No easy times lie ahead of you. You will long be regarded as interlopers, as cuckoos in a hedge-sparrow's nest. Man is by nature *chauvinistic,* and the medical man perhaps more than others is prone to look with jealous eyes upon a foreign transplant to his bailiwick. Only by dint of proving your superior worth will you be forgiven your trespass.

That you will know your subjects well, that you will strive to contribute to knowledge, that you will be faithful teachers, are taken for granted, but whether the patients in the hospital over the way will appreciate your worth will depend as much on how you approach them as human beings as on your scientific attainments. For though some have expressed doubt on the subject, the art, which takes so long to acquire, can be practiced and taught in a hospital no less than in a home, but hardly in one where the wrecks of humanity are known by bed numbers—as No. 23 in Ward F—rather than by their personal names.

As teachers you will beware of educational fads. Many cure-alls are advocated; some even put into practice. System, however, counts far less than the native ability to awaken interest and spur curiosity to action. Significant curricular improvements have, no doubt, progressively been introduced into our peculiarly American medical course, but the material in teacher and student continues to average much the same; and the conjunction of a stimulating instructor and a receptive student produces results whatever be the educational system or apparent lack of system. One or two men who possess this rare gift of inseminating other minds may spread the reputation of a school far and wide.

Those of us who must sit on administrative boards spend much needless time in the vain effort to discover a philosopher's stone whereby to drive off the impurities from our methods of teaching, of grading, of examining and at the same time of stimulating students. Our predecessors did likewise and theirs before them. But then, we appear to have more ground to cover than did they, and so the modern scholastic machine becomes more complicated. Meanwhile, we encrust our cylinders by pouring in too many pupils, who represent the oil; we feed in too much preparatory instruction, which is perhaps the gas; and when we find the car does not run smoothly we timorously juggle with the curriculum, a sort of institutional carbureter better left alone unless we are willing to face the prospect of a complete overhauling. Such an overhauling the machine has just had and the engine has acquired a new and unfamiliar "knock." It is returned to us as a far better car than ever before, but it is vastly more expensive to run, and its presumed primary function of providing the community with a sufficient number of capable practitioners seems to have been lost.[2]

But while this is a general complaint each institution has its individual problems to face. In this school you have already taken steps to greatly restrict your possible numbers. Bigness has its disadvantages and the country is strewn with institutional dinosaurs too unwieldy for survival. A small unit is often more effective even if proportionately less economical than a large one. But even with small classes there is a danger you will certainly avoid—what some wag has called the convoy system of education, whereby progress is measured by the speed of the slowest ship. Let us hope, too, that you will hold in due proportion the proper values of the science courses to be taught

[2] The sanitarian tells us that what we need is not doctors but public health officials who have put the country doctor quite out of business. There is some truth in this; but the garbage can and the water supply apply only to infection. The public health official would be doubly welcomed in town or village if he at the same time was a good doctor. Meanwhile the chiropractor thrives.

in this hall and the practical courses in the clinics near by, which some of us feel have of late years been over-much neglected. So much neglected in fact, that certain schools are on record as desiring only those students who are prospective medical scientists; as though, after all, there could be any higher aim than to turn out the highest type of general practitioner. With this as our aim, there will always be a certain percentage of esoterics to be admitted to the inner circle and who by preference will devote their lives to investigation and teaching. By hothousing an entire student body, we are not likely either to increase in number or to make more vigorous those who naturally comprise this rare and highly prized group.

Fortunate is the school that keeps such an even balance between the art and the science of medicine that they go hand in hand through the four years; and even though clinic and laboratory be equally represented in their allotment of time, fortunate, too, is the school in which from the outset teaching is in terms of the future patient rather than of the present frog and guinea pig. But we clinicians, particularly those on the surgical side, begin to be a little doubtful of the existing program. We find that the two preliminary years of training in laboratory methods, conducted by teachers who themselves have had no clinical experience, fail to provide the student with the information, resourcefulness and observational training that would be most useful to him in his later semesters. And since two years of anticipatory science are required before matriculation, the prospective doctor must have determined upon his career four years at least before he ever comes in contact with a patient at the bedside.

Science and practice are by no means contradictory. Observation, reflection and the testing by experiment are qualities required for each; and the art, which is so long, demands experiences the laboratories can not give: the ability to properly elicit a telling clinical history, to satisfy the importunings of the family, to gain a patient's confidence, to make him comfortable in mind and body regardless of what is wrong. These things are not by any means incompatible with the most intense scientific interest as to the cause, nature and extent of his malady, but they demand judgment of quite a different order. Refinements of laboratory procedure in the diagnosis of many disorders have outstripped any possible use we may make of them in treatment; and it is the art which alone tells the wise physician where scientific study must give way to, or at least be supplemented by, common sense.

Lest I be misunderstood, may I tell a story? In a hospital, distinguished for its highly scientific methods, special studies were being made of renal function for which a number of aged nephritics in the wards provided the necessary material. A fourth-year student, who happened to be a reformed osteopath, was at the time acting as a clinical clerk. Observing that there was no special treatment prescribed for these cases, he asked if he might see what he could do. He might, of course. So that evening, after the ward was smoothly tucked in for the night, he went to the bedside of a man in whom the disease was advanced and said, "John, what do you really complain of anyway?" "Backache, and I can't sleep," said John. "That's easily fixed," said the student. "Your spine's out of joint. Turn over on your face." So the immaculate coverlets were disarranged while John's back was given some deep massage. The next morning after an unusually comfortable night he told the somewhat annoyed head nurse that at last he had found a doctor who could do something for him. We are all in agreement that the German curricular system of the last fifty years has been far more disposed to the advance of medical science than has been, let us say, the British system; but there is one question rarely heard asked on the continent, though commonly put at the conclusion of a bedside examination in an English hospital—"And now, Mary, how do you feel in yourself?"

The pendulum has swung far—so far in fact that one is led to inquire, Can there, by any possibility, be such a thing as too good a preparation for medicine? It depends of course on what we are going to use it for. Some months ago I was shown the massive concrete foundations, three stories deep and five years in building, which have been laid in the expectation that some day they would support the nave of a great place of worship. At present, they serve to carry a flimsy canvas-covered framework to keep off the weather. Are we not perhaps doing this sort of thing in the case of our medical students, many of whom will be incapable of erecting much of anything upon the expensive reinforced foundation we lay for them and in which they become set and unresourceful?

Better, you will say, than to build on foundations of rubble a top-heavy clinical superstructure which must be continually shored up in later years lest it collapse. But since education is a lifelong process, we are all conscious of persistently shoring up to atone for educational deficiencies which could not possibly have been anticipated. Between these two extremes, a happy medium must be found. And there is no better goal, I think, than to aim from the beginning to make of every student a capable practitioner. In this process, as well as in any other, the exceptional men will come to the top; those gifted with a scientific imagination will feel the appeal of a life devoted to investigation; the majority, meanwhile, will find themselves prepared for a profes-

sional career no less rich in opportunities both for service and for research. Harvey and Hunter and Jenner, Koch and Lister, all made their great contributions while so engaged. It was a young and unknown orthopedic surgeon who recently startled the world by a discovery, made, in the pursuit of an idea, under circumstances which might well have discouraged a more highly trained laboratory investigator. Is there not some reason to ask whether our present system of forcing students into too long a preparatory mould, may not inhibit the more fertile minds rather than provoke them, with freshness of conception, to grapple some one of the many great problems that lie unsolved about us?

There can be no doubt but that each of us, science teacher or clinical teacher, feels some pride in the perpetuation of our individual species. It gratifies the physician or surgeon, no less than the physiologist or teacher of hygiene, if the students with exceptional abilities catch the appeal of his particular kind of work and become disciples. But a really good student, given a succession of stimulating instructors, invariably feels, or should feel, that he could be quite happy to continue for his life's work in the immediate subject at hand. In this, the clinicians have the advantage, for they get the students last; and if the teachers of the preclinical sciences feel themselves at a disadvantage, there could be no better way, as I have once before suggested, than to reverse our entire system: to regard the clinic as basic and subsequently to send to the experimental laboratories those capable of profiting by advanced and supplementary instruction. As many—perhaps more—students than at present might thus be inspired to devote their lives to science.

This is an utterly impracticable suggestion, I am quite aware, but after all, is it not the correct method of presenting the natural history of disease? In botany, for example, we begin with the identification of the flower or plant, with its variations and habitat, and subsequently dissect it in order to study the finer structure and function of its parts. In medicine, we have come to reverse this process—to begin with the pieces and to build up a picture of disease long before an illustrative example has ever been seen. Thus may a student glibly and fully enumerate the symptoms, let us say, of typhoid fever—but presented with a patient showing a few of these symptoms which he must himself learn to detect at the bedside, he can't for the life of him reverse his mental processes and construct typhoid fever out of what plainly lies before him.

If I were setting out to make a doctor of a young man entering a medical school where he could do what he chose, I would say spend your four years in three places—the anatomical dissecting room, the dead house and the clinic. In these three places (provided the anatomist is not prohibited from a consideration of function) you will hear spoken of or see illustrated at some time or other in your course all that is vital in our present-day medical knowledge. These places represent the workshops of the three fundamental subjects from which all others have branched off; and yet they have come to be perhaps the most neglected in some of our greater schools in which the confused and somewhat restive student is passed through a mill which, in great part, has no apparent relation to his ultimate goal.

Even when the relation is obvious, it would seem to be a needlessly long and uninteresting process. The anatomist describes the form and situation of the pancreas; the embryologist shows how it buds off from the gut; the histologist in turn points out the acini and the islets; the physiologist presents the accepted theories of the manifold functions of the normal organ; the biochemist discloses the complicated ways of detecting and of quantitating the various sugars; the pharmacologist perhaps demonstrates the action of the newly discovered insulin and explains how it is prepared; the pathologist, getting down to more solid ground, shows in turn the diseased organ; and finally after two years of this, the student first sees a patient with symptomatic evidences of pancreatic disease, possibly brought to light by a carbuncle or a gangrenous toe.

How much simpler to have shown the patient first, to have briefly explained how diabetes came to be recognized and what its complications may be, how step by step the mysteries of carbohydrate metabolism have partly been unravelled and the principles of our present-day treatment established—in short, the solid facts of the matter in the order in which they were discovered. Is not this the logical method of presenting our increasingly complex subject? Are we not, in short, putting our educational structure upside down; and even if not quite so bad as this, should not our foundation stones at least be cemented by a clinical mortar? Could science be prevailed upon to concede to the clinic from the beginning of the course a single hour a day, if necessary from eight to nine in the morning, for a series of carefully graded exercises, with chief stress on the training of observation but in terms of the patient, the average run of students would certainly face their subsequent laboratory hours not only with greater interest but with a clearer appreciation of why it is necessary to get the best possible scientific grounding for their future career.

I am inclined to think that the really great teachers, could we recall them, would regard this as the most

natural approach to the teaching of the fundamentals. Our scientific instruments are better, of better material, more numerous and more precise. We can not only see further, hear deeper, measure finer, travel faster and all that; but the scientific imagination and powers of generalization of the men behind the instruments is no different or better than a century, indeed twenty centuries ago.

These were qualities, possessed, I imagine, in their highest form by the founder of this medical school, Nathan Smith, who was professor of theory and practice of physic, surgery and obstetrics—a title of Hippocratic comprehensiveness. But the other members of that first faculty of four were perhaps no less eminent. The Nestor of American science, Benjamin Silliman, taught chemistry and pharmacy; Eli Ives, materia-medica and botany; and Johnathan Knight, of blessed memory, who served this school for half a century, began as professor of anatomy. If a comparable quartet of teachers could be gathered anywhere to-day, what father would not regard his son about to enter medicine as fortunate could he be apprenticed to them for a two years' course. Imagine the opportunities given those first small classes to become imbued with a scientific spirit and to enjoy a preceptorial system at its best!

May I briefly sketch the career of the man who is said to have been the first to matriculate in this school —one Jared Potter Kirtland. Not a college graduate, he received his medical degree here in 1815, promptly married and entered practice in Wallingford, whence, after three years, he moved to Durham on invitation from the town officials. There he became widely known as a successful doctor who nevertheless found time to gratify the taste for natural science which Silliman's lectures had awakened. Owing to the death of his wife in 1823, when thirty years of age, he migrated to Ohio to join his father, who was one of the early Connecticut "Reservists." There in the hamlet of Poland he not only built up another extensive practice, but served his community in other ways, being sent in 1827 as representative to the state legislature to which he was several times reelected. As a teacher of medicine he was much sought after for a period of thirty years. In 1835 he was elected professor of the theory and practice of medicine in one of the Cincinnati medical schools founded by Daniel Drake. In 1841 he accepted a similar chair in the newly established school at Willoughby. Five years later he was one of the founders of the Western Reserve Medical School in Cleveland and taught there until 1864. Meanwhile, beside being active in organizing a State Medical Society, of which he became president, he served on the first geological survey of the state and his collection of specimens made at that time was the basis of the first Museum of Natural History in Cleveland, for which he made a great ornithological collection. He found time to make a thorough study of the native wild plants. He examined and described all the fish of the lake and rivers of the locality. He was an eminent conchologist and made important contributions to the knowledge of the subject. When the National Academy of Sciences was founded in 1863 he was chosen one of the early members. His later years were passed upon a farm where he investigated the habits of bees and devoted himself to experimental agriculture, studying the fertilization of the soil, selecting the grains, grapes and fruits of various kinds best suited for the climate, the best breeds of cattle, sheep and hogs. He was a man as remarkable in his way as the late Jonathan Hutchinson. Educated to be a doctor, successful in practice and beloved of his patients, a renowned teacher, a most public-spirited citizen whose native abilities as a student of natural science were fully employed for the benefit of his community. Could there have been a better rounded-out life, or one which more effectively confounds our educational theories?

There was another early graduate of this school whose career I would like for a moment to dwell upon, since one of my earliest recollections is connected with him. As far back as I can remember, there hung above the desk in my father's office an engraving which showed a man in an out-of-doors clinic surrounded by a group of Orientals with bandaged eyes. One of them seated before him seems about to be couched for cataract. Through this picture I first learned of the Rev. Peter Parker, M.D., who went to the Far East as a medical missionary, founded at Canton the first hospital in China, made a great reputation chiefly as an ophthalmic surgeon, became secretary of the American Legation and finally minister to China, in which post he served with great distinction. Somewhere among your possessions is a series of remarkable canvases painted by Chinese artists showing many of the rare conditions of disease that Parker had observed in the Orient. When he entered Yale College, nearly a hundred years ago, he wrote in his diary:

> I am much pleased with President Day. I expect to serve as a waiter in the dining hall and this will pay my board. I have purchased me a bedstead and a mattress of moss for $4.25 and my bedding is furnished by a benevolent society. I know nothing about my class but I presume I shall like it.

There are potential Kirtlands and Parkers among your present students—men no less capable of success in one or more of the many walks for which a medical education should prepare them, whether it be as practitioner or specialist, as scientist or public

servant. Can the Nathan Smiths and Benjamin Sillimans of our present-day faculties make any better produce of the raw material in their hands?

So while we rejoice that the Yale Medical School through the erection of this new Sterling Hall is at last provided with laboratories admirably equipped not only for research but also for the instruction of students in the methods of science, let us hope that from the outset these preclinical subjects will so far as possible be presented in terms of the ill or maimed patient across the way. There far more than here, where normal structure and function is largely dealt with, is experience found fallacious and judgment difficult.

HARVEY CUSHING

HARVARD UNIVERSITY

THE CAUSES AND PREDICTION OF EARTHQUAKES

EARTHQUAKES can be predicted as to time and place but the strength of the quake is uncertain, the element of time is long and the place is large. We may say with some certainty that there will be an earthquake in California during the next week and it is practically certain that it will occur. This statement is based on the fact that there has been, each week during past years, a recorded earthquake shock, or at least one would have been recorded had there been a sufficient number of recording stations in the state of California. These earthquakes vary greatly in intensity. In 1906 an earthquake occurred near San Francisco causing great destruction of property. Within the last two years an earthquake occurred in southern California which caused some damage. Many earthquakes have occurred which were felt by man but which caused no material damage. However, by far the greater number of earthquakes have not been felt by human beings but have been recorded on the very delicate instrument called the seismograph.

We may predict that, within the next century, a heavy destructive earthquake is likely to occur along the Atlantic coast. This is a logical deduction from the fact that, in the early part of the last century, there was a destructive earthquake in New England, and in 1886 there was a destructive earthquake in Charleston, South Carolina. We may predict, however, with reasonable certainty of fulfillment that there will be an earthquake on the Atlantic coast within the next year or within the next five years; this is based on the evidence that many earthquakes have occurred along the Atlantic coast during recent decades, some of which have been felt but most have only been discovered by the seismograph records.

It also seems to be reasonably certain that we shall have a heavy earthquake during the coming century in the Mississippi valley, for, in 1811, there was a very destructive earthquake in the vicinity of New Madrid, Mo.

Scarcely a day passes without there having been recorded on a seismograph, located at one of the many stations of the world, an earthquake with some degree of severity. The newspapers are giving attention to this subject as is indicated by their frequent notices of earthquakes.

A few such notices are:

December 1, 1923, dispatch from London. A severe earthquake shock was felt in the Ceprano district, Rome Province, during the night.

December 3, 1923, dispatch from Tokyo, Japan. A sudden and severe earthquake which lasted 40 seconds was felt at Nagoya, 171 miles southwest of Tokyo, on the island of Bondo at 10:18 o'clock last night according to advices received here. Residents of the city were badly frightened but no damage was done.

December 15, 1923, dispatch from Bogota, Colombia. Many persons have been killed and many injured by an earthquake which to-day destroyed two small towns in the region of Ipiales, near the Colombia-Ecuadorian frontier. The report has it that 85 dead have been recovered from the ruins of Cumball which with the town of Chile suffered most severely from the effects of the shocks, according to report received.

December 20, 1923, report from Douglas, Arizona. According to a report received by the president of Agua Prieta the Mexican towns of Granados, Huasabas and Oporto were razed by an earthquake about nine o'clock last night. Many were killed and injured according to the reports.

December 22, 1923, Guayaquil, Ecuador. Three new earthquake shocks have been felt in Tulcan.

The short space of time during which the above mentioned earthquakes took place gives some indication of the great number of rather severe earthquakes which occur over the earth's surface during the course of a year. Many severe earthquakes occur in regions where there are few or no inhabitants and again in other places where communication is so difficult that reports are not received concerning them.

While we may predict an earthquake for a certain general region, it is a very much more difficult matter to make a prediction for a small area such as that covered by a city or even a county. In fact, one would be rather bold who would say that any one city in the United States is likely to have an earthquake of a destructive nature within any given period of years no matter how great.

The earth's surface has changed its elevation greatly in various places during geological time. It has been

stated by an eminent geologist that about 1,500,000,000 years have elapsed since the earliest existing sedimentary rocks were formed. During this period mountains have come and gone, and, in fact, some areas have been mountains and again covered by the oceans several times. The Himalayan mountains now have a maximum elevation of about 28,000 feet, more than 5¼ miles. Tremendous forces have been in operation to cause such great changes in the elevation of the earth's surface and with the changing there has been fracturing, crushing, folding and overturning of the sedimentary rocks, resulting in sudden movements. With these movements have occurred the tremors called earthquakes. If the rock has been very strong the stresses have accumulated to great proportions until the forces have overcome the resistance. The giving way shatters the rocks of the crust and produces a destructive earthquake. Of course, this term destructive must be associated with man and structures made by him. An earthquake could not be called destructive, no matter how intense, if there were no artificial structures within the zone of effective action.

Many of the earthquakes occur at sea, under the bottom of the oceans; these make their occurrence felt by the seismograph records and the great tidal waves which, sweeping across the ocean, rush inland destroying the works of man and human life. At times these tidal waves have torn ships from their moorings and carried them inland, leaving them high and dry when the waters receded.

The great source of energy which changes the elevation of the surface of the earth is gravitation. This force, acting on the water which falls to the ground as rain, sweeps vast quantities of eroded material from the uplands and deposits them along the margins of the continents. The equilibrium of the earth's crust, approximately 60 miles in thickness, is disturbed by this process. The magmatic or subcrustal material is pushed away from the region on which sediments are deposited and is forced by gravitation back towards the region from which the eroded material came. In one case, a portion of the earth's crust is pushed down into regions that are hotter, while in the other case the portions of the crust under areas of erosion are lifted higher to colder regions. In the first case, the material of the crust will be subjected to greater heat and in the second the material will lose heat. In consequence of this, chemical or physical changes will occur which cause an expansion or shrinking of the crustal material. It is these changes which are most effective in the upbuilding of a mountain mass or the sinking of a coast.

While change in density of the earth's material is taking place there will be much yielding of the earth's crust without fracture. But some of the yielding will be sudden, and then there will be an earthquake. Earthquakes are also caused by the sinking of the crust under the overload of sediments. This undoubtedly was the cause of the destructive earthquakes at Charleston, S. C., and New Madrid, Mo. There will be fracture of the earth's material, causing earthquake shocks in regions of erosion, for as the surface material is worn away and the region becomes lighter than normal, the subcrustal material will force up the crust, breaking and crushing strata.

The earthquake is merely a symptom of something more fundamental taking place in the earth's crust. The earthquake is the effect rather than the cause, just as we may say that for a human being the chill is a symptom of malaria rather than the disease itself.

WILLIAM BOWIE
U. S. COAST AND GEODETIC SURVEY

FIRST AWARD OF THE PENROSE MEDAL[1]

BY invitation from the council of the Geological Society of America, the first award of the Penrose Medal by the Society of Economic Geologists was made a special feature of the Geological Society's annual banquet, which was held in Prudence Risley Hall, Cornell University, Ithaca, N. Y., on the evening of December 30, 1924. After the dinner had been served, President Lindgren, of the Geological Society of America, called the diners to order and introduced President Kemp, of the Society of Economic Geologists, who spoke as follows:

A year and a half ago, under the presidency of Mr. J. E. Spurr, the Council of the Society of Economic Geologists passed a resolution to establish a gold medal, to be awarded by the society. A committee was appointed to carry the resolution into effect. On canvassing the situation, the committee learned that Dr. R. A. F. Penrose, Jr., the first president of the society, was ready to supply the die and to establish an endowment with whose income the council might award the medal once in three years. In conference with the committee, it was decided that the award should be made for "exceptionally original work in the earth sciences." In accepting the foundation, the council voted that the name of the "Penrose Medal" should be attached to the award. This year it has become possible to present the Penrose Medal for the first time, and after discussion among those members of the council who could meet together, and after correspondence with members at a distance, the council awarded the medal to Professor Thomas

[1] Presentation address at the first award of the Penrose Medal of the Society of Economic Geologists to Professor Thomas Chrowder Chamberlin.

Chrowder Chamberlin, of Chicago. The president was authorized to invite Professor Chamberlin to come to this meeting in order that the presentation could be made to him in person. Professor Chamberlin accepted the invitation and has come, but we are all inexpressibly grieved that a slight accident has prevented his presence at the dinner this evening, where, at the cordial invitation of the council of the Geological Society of America, it was our plan to give him this token of our profound respect and affection. I will, however, as president of the Society of Economic Geologists, give expression to our thoughts and will then ask Professor Stuart Weller, Dr. Chamberlin's colleague and traveling companion, to accept it in his behalf and convey it to him.

Thomas Chrowder Chamberlin graduated from Beloit College, Wisconsin, in 1866, when Beloit was the largest institution of collegiate grade in the state. As has been the case with so many geologists after leaving college, he taught for two years, remedying thereby the financial inroads of four years of collegiate study, and accumulating the means of further graduate preparation. In the fall of 1868, he entered the University of Michigan and spent a year in the study of the natural sciences, becoming at its close professor of these branches in the State Normal School at Whitewater, Wisconsin. In 1873, he finally squared away on his definite career as a geologist when he received the appointment as professor of geology in Beloit. At the same time, he became assistant state geologist of Wisconsin, and, in 1876, chief geologist of the State Survey, a position which he held, together with his professorship, until 1882. During these years, the familiar green-bound, royal octavo volumes of the Survey were prepared, which are familiar to us all and which are on the shelves of all our university libraries. In them, we find the studies of the gash veins of the Upper Mississippi Valley, which had been productive of lead since the early French colonization, and which continue to supply both this metal and still more important quantities of the later utilized zinc. Professor Chamberlin's studies were detailed and exact; his interpretations, original and interesting. All students of mining geology have read them and know them, but not all are aware that with the printed text went also an atlas of maps of very large scale, in a portfolio of such size as to be the despair of librarians, and to be stored, almost invariably, so remote from the reports as to escape observation. On the large scale maps are plotted all the gash veins known at the time, and in such detail that the charts are of great service to the mining profession even to this day. The contribution is of special interest to the members of the Society of Economic Geologists, and I cite it as the first in a series of outstanding contributions to the earth sciences.

The gash veins appear in the driftless area of Wisconsin, and we may wonder if Professor Chamberlin was attracted to the deposits of the Ice Age by his studies of the driftless area in accordance with the old classic absurdity of lucus a non lucendo; *i.e.*, that a light is a light because it does not shine. At all events, we find his later contributions to glacial geology attracting such attention that a Division of Glacial Geology, of which he was appointed chief, was established in the United States Geological Survey, in 1882, in the third year of the Survey's activity. All familiar with the Survey's history recall at once that the first two directors, Clarence King and Major Powell, were farsighted in selecting for monographic treatment subjects of outstanding interest, such as Lake Bonneville, the Grand Canyon, Eureka, Nevada, the Comstock Lode, Leadville and several more. To these was added, in 1882, the great problem of the past and gone continental ice sheets. A moment's reflection will remind us also that under the investigations of the Division of Glacial Geology, the scattered moraines, eskars, drumlins and deposits of modified drift began to assume systematic relations, and to become amenable to time classifications comparable with the results of stratigraphic work upon the hard rock formations. To Professor Chamberlin's twenty-one years as chief of the Division of Glacial Geology, we owe in the largest degree these striking results.

Meantime, in 1887, he had been called to the presidency of the University of Wisconsin, and had taken up the work inaugurated and carried well along by his predecessor, President Bascom, in making the university truly representative of the great state in which it was situated. For five fruitful years, Dr. Chamberlin held the office and then the establishment of the University of Chicago opened up to him a chair, with true university opportunities, with well-qualified colleagues, and with the *Journal of Geology*. From administration, Dr. Chamberlin turned to instruction and investigation, and again apparently by the principle of contrasts began to direct his attention less to the latest of geological time divisions and more to the remotest of all. With the aid of his colleagues in astronomy and mathematics, he began to formulate a conception for the origin of the solar system and of the other groups of heavenly bodies. In the course of years, the planetesimal hypothesis reached precise expression and took its place in geological literature, on terms of equality with the older conception of the nebular hypothesis. Not only this, but many other contributions were made, resulting

from studies which lie in the realm between geology and astronomy.

Side by side with these essays came others in the fundamental principles for the classification of geologic time, and most notably arguments favoring the successive diastrophic upheavals as the events which marked off the eras and periods from one another. These contributions constitute a fourth group to be mentioned on an equal footing with the other three cited.

In summary, I may, therefore, select from the long series of contributions which Professor Chamberlin has made to our science the four which may be described, in accordance with the phraseology on the medal, as "outstanding contributions to the earth sciences":

(1) The contributions on the lead and zinc veins of the Upper Mississippi Valley.

(2) The contributions on the Ice Age.

(3) The contributions on the Planetesimal Hypothesis and on the subjects which lie along the borderland between geology and astronomy.

(4) The contributions on Diastrophism as a principle in the subdivision of geological time.

Not alone for these, however, do we award the Penrose Medal. It is, also, an expression of the deep affection and respect with which Professor Chamberlin is universally regarded by geologists, at home and abroad.

SCIENTIFIC EVENTS

THE BRITISH ANTHROPOLOGICAL INSTITUTE

THE Royal Anthropological Institute, according to the *British Medical Journal*, has been promised a substantial grant, from the trustees of the Carnegie United Kingdom Trust, for the development of its library. This grant has been made by the trustees in pursuance of their policy of linking up special libraries with the General Library for Students. By an arrangement with the Royal Anthropological Institute, the books and periodicals in the library of the latter, except such as are rare or irreplaceable, will become available to the general public who make application for the loan of books through the central library. The central library will thus be relieved of the necessity of buying such books, and at the same time will have the benefit of the expert knowledge and guidance of the officials of the institute. As the institute's library includes a wide range of periodicals, some of which are not elsewhere accessible in this country, these facilities should be of considerable advantage to students who are not in a position to obtain access to anthropological literature through other channels. Mr. C. G. Seligman, president of the Royal Anthropological Institute, states that the council of the institute is influenced by a desire that its facilities for the study of man should become more widely known. The council holds that knowledge of the racial affinities, ways of thought and social organization of the primitive peoples of the British Empire can not be too widely extended among the general public, if only to bring about a fuller appreciation of the importance of the study of anthropology in helping to solve the difficulties of administration among backward peoples. In spite of the grant made by the Carnegie trust and the sums subscribed by its fellows, the institute is still far from being in a position to undertake the whole of the work that it is its duty to perform. He therefore appeals, not only to those whose interest in anthropology is academic, but also to those who realize that a sound knowledge of ethnology is an essential factor in the equipment of colonial administrators. It is on the knowledge which the latter may acquire that the well-being and security of colonial possessions depend. For the British Empire, the problem of the government of native races exists on a scale much greater than for any other power.

THE ADMINISTRATION OF PATENTS BY COLUMBIA UNIVERSITY

COLUMBIA UNIVERSITY will hereafter be prepared to take over patents arising from discoveries made in its own laboratories. Sanction of the Board of Trustees has been obtained for the plan. To take care of cases arising from this ruling, an Administrative Board of University Patents has been established, with the following members:

President Nicholas Murray Butler; Treasurer Frederick A. Goetze; Frederick Coykendall and Archibald Douglas, trustees; Walter I. Slichter, professor of electrical engineering; Ralph H. McKee, professor of chemical engineering; Frederick T. van Beuren, associate dean of the medical school; Thomas Ewing and Dr. Milton C. Whitaker, former professor of chemical engineering.

The trustees acted upon the recommendation of the Committee on Education,

that while no university officer should be under compulsion to assign to the university any patent that might be issued to him for a discovery of his own, even if that discovery were made in the university's laboratories, nevertheless the university should be prepared to accept the assignment of such patents in cases where that action approves itself to the judgment of a competent university authority.

Members of this board in handling the inventions so patented may

make arrangements on such terms and in such way as they may approve for the use, manufacture, sale, or other disposition thereof, or of rights therein, with power to arrange for the use or division of the proceeds thereof.

The powers of the board also extend to trademarks or proprietary names and copyrights of literary works owned or produced by members of the teaching staff and others. In other words, this board

has been given authority in their discretion, subject to the direction and control of the trustees, to accept for and on behalf of the university by assignment or otherwise, either directly or through trustees or holding corporations, patents, patent applications, royalties, licenses, or rights therein, covering discoveries, inventions, or processes, whether produced by members of the teaching staff of the university, by use of university laboratories, or otherwise.

The central purpose is by the cooperation of the university, to protect the discoverer or inventor of a patentable article or process, to insure that the public be served under the best possible conditions and at a reasonable price and to enable the university itself to share in the benefits of the patent, to the end that the funds at its disposal for the promotion of research may be increased.

Official discussion of the problem began at Columbia following the discovery by Dr. Theodore F. Zucker, associate in pathology, of a chemical product which appears to be a specific remedy for the disease of rickets, common among young children. Dr. Zucker desired to assign to the university the patents issued to him to cover this invention, with a view of assuring to the university the royalties and safeguarding for the public a new and effective medical remedy made under the best possible conditions and sold at a reasonable price.

GEOLOGY AND PHYSIOGRAPHY AT THE NORTHWEST SCIENTIFIC ASSOCIATION

AT the first annual meeting of the Northwest Scientific Association held in Spokane on April 10 and 11, 1924, a section of geology and geography was organized under the chairmanship of President C. H. Clapp, of the University of Montana. The section met in two sessions and a number of papers on the geology of the Northwest were read. For the meeting in April, 1925, in addition to the reading and discussion of papers a short excursion has been proposed. Within the limits of the city of Spokane is to be found much of geological interest and the local workers are desirous of having their observations "checked" by visitors. The objective selected for the excursion is the gravel-pit at Pantops near the southeast corner of the city. Chief interest here is in an unusual deposit of gravel of glacial outwash origin in which are great numbers of large angular, unworn boulders which appear to have been "plucked" from the top of Little Baldy, a low mountain five miles distant on the north side of Spokane Valley. The electric railroad in using this gravel has exposed several acres, removing the gravel from the boulders. The deposit appears to have been laid down in the water of glacial "Lake Spokane" (SCIENCE, N. S. Vol. LVI, pp. 335–336, 1922). This place is at the eastern margin of the local glaciation. In the immediate neighborhood of Pantops may be seen crumpled crystalline rocks (Pre-Cambrian?), Tertiary basalts and "micaceous clays" bearing fossil leaves (also Tertiary), the beginning of the "Columbia Scablands," where the ice-diverted Columbia drainage swept the basalts bare and a post-glacial lake (Glenrose) now in prosperous farms. Typical glacial ground moraine similar to that of the sandy parts of the "lake states" may be seen on the west border of the Glenrose basin.

Transportation will be furnished to those indicating their wish to go on this excursion at the time of registration. The route, going, is for almost the entire distance over the moraine of a glacier which seems to have stopped against the basalt cliffs on the south side of the valley at this place. An intermediate point of interest is a pile of enormous ice-moved, basaltic boulders mingled with other morainic material. For those who wish to do so the return may be along the line of the electric road on foot. This distance is about three miles. To be seen is the contact of basalt and the earlier crystallines, contact of successive lava flows and interesting erosion and basalt forms.

To those who can spend more of the week in geological exploration attempt will be made to furnish competent guides. It is believed that the region will well repay a careful study with Spokane as a base. Outstanding geologic features are, the "fossil Tertiary valleys" cast in basalt at the margin of the great Columbia lava-flow, the beds of plant fossils, the Palouse soils, the evidences of successive glaciations and the effects of ice-diversion of the Columbia drainage, in particular the Mica Outlet of "Lake Spokane" and the North Pine Creek-Rosalia channel as representing farthest east diversion of Columbia River (Grand Coulee being the farthest west).

T. LARGE,
Acting Secretary

SPOKANE, MARCH 7, 1925

THE MADRID INTERNATIONAL GEOLOGICAL CONGRESS

ANNOUNCEMENT of the preliminary plans for the Fourteenth International Geological Congress has been received from the office of the general secretary, Senor E. Dupuy de Lôme, at the Geological Institute of Spain, Plaza de los Mostenses 2, Madrid. The congress will be held in Madrid in May and June, 1926.

Following the practice of earlier congresses, the

Committee on Organization presents a number of topics as subjects for special discussion or symposiums. The provisional list, which is subject to emendation and extension, is as follows:

1. The world's reserves in phosphates and pyrites.
2. Geology of the Mediterranean.
3. Cambrian and Silurian faunas.
4. Geology of Africa and its relations to that of Europe.
5. Tertiary vertebrates.
6. Hercynian folds.
7. Tertiary Foraminifera.
8. Modern theories of metallogeny.
9. Vulcanism.
10. Geophysical studies: (a) Their application to geology, (b) necessity of unification of the gravimetrical methods.

As with former congresses, excursions are being arranged to cover a large number of regions and localities of particular interest to the stratigrapher, the paleontologist, the metalliferous geologist, the physiographer, the tectonic geologist and others. These most alluring excursions, fuller particulars of which will later be issued by the committee, will take place before, during and after the congress, according to arrangements yet to be completed. Senor C. Rubio, president of the Board of Mines and former director of the Geological Institute of Spain, who headed the Spanish delegation at the last congress, held in Brussels in 1922, is president of the organizing committee.

In accordance with previous sessions the congress will be in its make-up thoroughly democratic and autonomous. However, admission to the excursions will be specially reserved for members of the congress who are geologists, geographers, mining engineers or persons engaged in the study or application of some branch of geology. Communications and papers to be submitted may be written and presented in French, English, German or Spanish. Authors submitting titles for the programs are requested to attach abstracts not longer than one page of printed text, and these should be typewritten and in duplicate.

Interest in this congress appears to be widespread among American geologists and it is understood that a considerable number are making arrangements to be in Madrid in the spring of 1926. The secretariat announces that the guide book for excursions is already in preparation. Everything, in fact, points toward a very successful and profitable session of the congress.

THE JOSEPH LEIDY MEMORIAL AWARD

THE Academy of Natural Sciences of Philadelphia, as was noted in SCIENCE last week, has selected Dr. Herbert Spencer Jennings, of the Johns Hopkins University, as the recipient of the first award of the Joseph Leidy Memorial Award. The selection of Dr. Jennings was made by the academy's committee on the Joseph Leidy Memorial Award, "in appreciation of his researches upon the Protozoa and the Rotatoria, and in recognition of his broad knowledge and keen understanding of the significance of biological phenomena."

The Joseph Leidy Memorial Award was endowed by a fund created in 1923, as a trust with the academy, providing for the award of a bronze medal every three years, accompanied by an honorarium, "as a reward for the best publication, exploration, discovery or research in the natural sciences in such particular branches thereof as may be designated, which award of said medal and honorarium once in three years and the conditions and limitations attending the same and all matters connected with the gift, shall be determined by a committee to be selected in an appropriate manner by the academy."

The committee, whose recommendation has been approved and accepted by the council of the academy and the academy itself, consists of Witmer Stone, *chairman*, R. A. F. Penrose (*ex-officio*), Henry Skinner, Henry A. Pilsbry, Henry W. Fowler and James A. G. Rehn, *secretary*.

The presentation of the award will be made at a special meeting of the academy to be held in the near future.

SCIENTIFIC NOTES AND NEWS

MEMORIAL exercises in honor of Thomas Corwin Mendenhall will be held on April 16 in the University Hall of the Ohio State University. The program will include addresses by Dr. Ira N. Hollis, president of Worcester Polytechnic Institute; by Dr. Charles Frederick Marvin, chief of the United States Weather Bureau, and by Dr. Elihu Thomson, director of the Thomson Laboratory of the General Electric Company, Lynn, Massachusetts. These addresses will be followed by the presentation by the Mendenhall family of a bronze replica of the portrait medallion of Dr. Mendenhall given to him by his first group of students on the fiftieth anniversary of the opening of the university on September 17, 1923.

SIR E. JOHN RUSSELL, director of the Rothamsted Experimental Station, Harpenden, England, has been elected a corresponding member of the Paris Academy of Sciences, in the Section of Rural Economy, in succession to Professor Winogradsky, who has been elected a foreign associate.

DR. HARRIS J. RYAN, professor of electrical engineering at Stanford University, received the degree of doctor of laws from the University of California on

March 23 in recognition of his contributions to the knowledge on the subject of high-voltage transmission and phenomena.

THE doctorate of science has been conferred upon Mr. William Schaus, honorary associate curator in the Division of Insects in the United States National Museum, by the University of Pittsburgh on the occasion of the celebration of charter day. The degree was conferred in recognition of his discovery of thousands of new species of Neotropical Lepidoptera.

THE honorary degrees to be conferred by Trinity College, Dublin, include the degree of master of surgery on Dr. George Crile and Dr. Charles Mayo.

CAMBRIDGE UNIVERSITY proposes to confer honorary degrees upon Professor John Joly, professor of geology and mineralogy in the University of Dublin.

MLLE. IRENE CURIE, daughter of the discoverers of radium, received the degree of doctor of science at the Sorbonne, on April 1.

PROFESSOR DOUGLAS W. JOHNSON, of Columbia University, has been awarded the Edouard Caudy medal by the Société de Geographie Commerciale de Paris.

THE Malaria Commission of the League of Nations Health Organization ended its sessions at Geneva on March 30, after the nomination as corresponding members of Dr. Samuel Taylor Darling, Professor Brumpt of France, and Colonel Christophers of England.

THE Franklin Institute has awarded to Harvey C. Hayes, of the Naval Research Laboratory, Anacostia, D. C., the Louis Edward Levy gold medal for his article on "Measuring ocean depths by acoustical methods."

AT the University of Cambridge the Adams prize for an essay on "The physical state of matter at high temperature" has been awarded to R. H. Fowler, Trinity College. A Smith's prize has been awarded to T. G. Room, St. John's College, for an essay on "Varieties generated by collinear stars in hyperspace."

DR. JAMES B. MURPHY, member of the Rockefeller Institute for Medical Research, has been elected a foreign member of the Deutsches Zentral-Komitee zur Erforschung und Bekämpfung der Krebskrankheit of Berlin.

WE learn from *Nature* that at the annual meeting of the Ray Society on March 12 the following officers were reelected: *President,* Professor W. C. M'Intosh; *treasurer,* Sir Sidney F. Harmer; *secretary,* Dr. W. T. Calman. Lord Rothschild was elected a vice-president, and Professor A. E. Boycott and Mr. R. T. Gunther were elected new members of council.

DR. J. R. SCHRAMM has resigned his position as professor of botany at Cornell University, as of date of next June, and will become editor-in-chief of the new *International Biological Abstracts.*

NOAH T. CLARKE, son of Dr. John M. Clarke, director of the State Museum at Albany, who has been a technical assistant in the museum since 1912, has been appointed by the New York State Board of Regents state archeologist to succeed Dr. Arthur C. Parker, who recently resigned.

DR. E. B. STEPHENSON, who has been physicist for the Corps of Engineers, U. S. Army, for the past five years, has resigned and accepted a position in the Naval Research Laboratory, Bellevue, Anacostia, D. C., where he will be engaged chiefly in subaqueous sound ranging work.

DR. A. BESREDKA, of the Pasteur Institute, Paris, and Dr. I. Abelin, Bern, have been given grants of $1,500 and $800, respectively, by the Ella Sachs Plötz Foundation for the promotion of scientific research.

RICHARD WHITMORE HARR, of Chevy Chase, Md., Sheffield Scientific School, '25, Yale University, has been awarded the Thompson-Starrett prize of $2,500 for work of exceptional merit in the course in building construction. He is the first recipient of the prize, which was established by Mr. and Mrs. Louis J. Horowitz, of New York City. According to the provisions of the award, Mr. Harr will receive practical training in building construction with the Thompson-Starrett Company.

DR. CHARLES G. ABBOT, director of the Astrophysical Observatory of the Smithsonian Institution, will conduct a joint expedition, planned by the Smithsonian Institution and the National Geographic Society, which has as its object the improvement of methods of long-range forecasting by measurements of the heat of the sun. Observations will extend over four years.

DR. SAMUEL T. DARLING sailed on March 21 from New York for Europe to become director of an expedition that will study the malaria condition in countries about the Mediterranean, under the auspices of the Rockefeller Foundation. The countries to be visited are Switzerland, Italy, Greece, Palestine, Egypt and Morocco. Dr. Darling will complete this work by July 1 and will then go to England to address a meeting of the Royal Society of Tropical Medicine at Oxford University.

THE Bureau of Animal Industry of the U. S. Department of Agriculture has selected the following

men of science to conduct research in Europe on the foot and mouth disease: Dr. Peter K. Olitsky, Rockefeller Institute for Medical Research; Jacob A. Traum, University of California, and Dr. Harry W. Schoening, of the Bureau of Animal Industry. The delegation will go to Berlin to investigate reports of the discovery of the causative organism and then collaborate with investigators of this problem in Budapest and Alfort, France.

It is reported by the Associated Press that an official German Agricultural Commission, the first to travel abroad since the war, left Bremen on the steamship *Columbus* on April 2 for a six months' study of the progress made in American agriculture during the last ten years. The members, appointed by the Federal Ministry of Food and Agriculture and by farmers' organizations, are Dr. Theodor Brinkmann, professor of farm economics at Bonn; Dr. George Keuhne, expert on agricultural machinery, of Munich; Dr. Theodor Roemer, professor of selective plant breeding, at Halle, and Joachim Deiche, a large farm owner and former director of the live stock breeding department of the German Chamber of Agriculture. The delegation will be received by the United States Department of Agriculture at Washington, which will plan separate itineraries for them, each to his own specialty. Dr. Fred Hagedorn, under secretary of agriculture, will accompany the commission and will himself make a study of American agricultural economics and finance.

Lincoln Ellsworth, American engineer, who will participate in Captain Roald Amundsen's flying expedition to the North Pole arrived at Oslo, Norway, on March 30. Mr. Ellsworth stated that it was expected the entire aerial trip would be accomplished in seven hours. If it proved possible to land, the expedition would remain at the Pole twenty-four hours for observation and exploration purposes. Captain Amundsen and Mr. Ellsworth left for Tromsöe on March 31. The Störthing has approved the government's proposal to put the naval transport *Fram* at the disposal of Captain Amundsen. This will involve an extra expenditure of only 25,000 kroner, as the *Fram* was already scheduled to go to Spitzbergen on scientific explorations and is capable of serving the two expeditions.

Leave of absence from Harvard University for the second half of the academic year of 1925–26 has been granted to Professor George D. Birkhoff, of the department of mathematics, western exchange professor during the first half of 1924–25, and to Professor Percy Bridgman, of the department of physics, for the months from November to March, to Assistant Professor Harlan T. Stetson, of the department of astronomy, and for the whole year to Assistant Professor Joseph L. Walsh, of the department of mathematics.

The Institute of Medicine of Chicago gave its first Ludvig Hektoen Lecture of the Billings Foundation at the City Club on March 27, when Drs. George F. and Gladys R. H. Dick lectured on scarlet fever.

Dr. Elmer V. McCollum, of the School of Hygiene and Public Health, of the Johns Hopkins University, lectured on March 16, at the American Museum of Natural History, under the auspices of the New York Academy of Sciences on "The application of laboratory studies in nutrition to human progress."

On March 24, Professor Joseph S. Ames, of the Johns Hopkins University, lectured on "Some scientific aspects of aviation development," before the Swarthmore Chapter of the Society of Sigma Xi.

Dr. Robert B. Sosman, of the Geophysical Laboratory of the Carnegie Institution of Washington, is giving a series of lectures at the Massachusetts Institute of Technology on the composition, temperature, structure and elastic qualities of the interior of the earth.

Dr. R. A. Gortner, professor of agricultural biochemistry at the University of Minnesota, lectured before the Akron (Ohio) section of the American Chemical Society on April 3, on "Biochemistry—the present and the future." On April 4 he spoke at Pennsylvania State College on "Colloids in living processes," under the auspices of the honorary chemical society, Phi Lambda Upsilon. Professor Gortner is national president of Phi Lambda Upsilon.

Professor Henry B. Ward, of the department of zoology, of the University of Illinois, gave an illustrated lecture before a joint meeting of the biology club and seminar of the department of biology of the James Millikin University, Decatur, Illinois, on March 24. His subject was: "Salmon, an example of research and conservation of national resources."

Dr. Gerald L. Wendt, dean of the department of chemistry and physics at Pennsylvania State College, spoke on March 27 before the combined chemical societies of Lafayette College, Lehigh University and the Lehigh Valley Section of the American Chemical Society. His subject was "The shattering of the atom."

William H. Geer, director of the department of physical training at Harvard College, died on April 1, from the effects of carbon monoxide poison while in his garage, after being unconscious for 117 hours. Dr. Geer was forty-one years old.

THE spring meeting of the American Society of Mechanical Engineers will be held at Milwaukee, from May 18 to 21.

THE Alabama Academy of Science held its annual meeting in Mobile, on April 3, in affiliation with the Alabama Education Association, under the presidency of Wright A. Gardner, Auburn. Mr. Sumner A. Ives, Birmingham, is secretary of the academy.

AN examination for junior entomologist will be held on applications received by the Civil Service Commission at Washington, D. C., prior to April 25. Vacancies in the Bureau of Entomology, for duty in Washington, D. C., or in the field, and in positions requiring similar qualifications, will be filled. The entrance salary in the District of Columbia is $1,860 a year. Advancement in pay may be made without change in assignment up to $2,400 a year. Promotion to higher grades may be made in accordance with the civil service rules. Both men and women are eligible. Applicants must have graduated with a degree from a college or university of recognized standing, with specialization in entomology. As a result of this examination, separate registers will be established of eligibles experienced in the following divisions: Deciduous fruits, cereals and forage crops, southern field crops, shade and forest trees, truck crops and stored products, apiculture, tropical and subtropical fruits, miscellaneous insects (including insects affecting the health of man and domestic animals), preventing spread of moths.

BEQUESTS for public purposes, amounting to about a million dollars, were made in the will of Wilson Catherwood, of Philadelphia. These bequests include one of $250,000 to the Zoological Society of Philadelphia.

AT a dinner given March 16 by Sir William Mulock, chancellor of the University of Toronto, which was attended by many representative citizens of Toronto, it was decided to give energetic support to the movement to raise $500,000 by popular subscription for the Banting Research Foundation. The Premier of Ontario, Mr. Ferguson, promised substantial support by the Province, and the Mayor, Mr. Foster, by the city of Toronto. It was further decided that the subscription books should be kept permanently open in the hope of securing a larger endowment for pure scientific and industrial research as well as medical research.

THE *Journal* of the American Medical Association states that an appropriation of two million dollars for the immediate construction of a fire-proof building at Walter Reed Hospital, Washington, D. C., has been provided by congress. This hospital is recognized as the medical center of the army. Special attention is given there to surgical and reconstruction cases. The Secretary of War plans to complete two wings to the main hospital building, which will be fire-proof and contain wards for patients. There will also be constructed an addition to the main hospital building containing dining-rooms, kitchens, wards, library, laboratory, observation and isolation wards. At present many patients are housed in temporary buildings erected during the war. The present appropriation will permit the construction of permanent fire-proof buildings sufficient to care for 700 patients.

FROM the 9,000,000 francs collected from the public on Pasteur's Day, the French Academy has recommended that, among others, the Laboratories of Physiology and Medicine receive 576,000 francs; Madame Curie's Laboratory in the Sorbonne, 170,000 francs, and the zoological laboratories, 630,000 francs.

THE Astronomy and Physics Club of Pasadena since the holiday recess has had the following program:

January 9.—*Motions in spiral nebulae:* DR. ADRIAAN VAN MAANEN.

January 16.—*Application of the cepheid criterion to the spiral nebulae:* DR. EDWIN P. HUBBLE.

January 23.—*The glands of internal secretion:* DR. EUGENE M. K. GEILLING, of the Johns Hopkins University.

January 30.—*Electric and diamagnetic polarization of gases:* DR. PAUL S. EPSTEIN.

February 6.—*X-rays and atomic structure:* DR. MANNE SIEGBAHN, of the University of Upsala.

February 13.—*A test of the relativity time transformation:* DR. ROY J. KENNEDY, National Research Fellow.

February 20.—*On the mechanism of chemical reaction:* DR. RICHARD C. TOLMAN.

February 27.—*The Washington meeting of the American Association for the Advancement of Science and related societies:* DR. JOHN A. ANDERSON.

March 6.—*Scientific research and the community:* PROFESSOR A. FINDLAY, of Aberdeen University.

A BRITISH party consisting of Messrs. Shelton, Bernacchi and Worsley arrived at the end of March, at Oslo, Norway, en route for the Finse-Bergen railway for the purpose of trying a new tractor intended for the Antarctic expedition they are about to undertake. The expedition intends to go to King Edward VII.'s Land, thence proceeding southward or eastward, and will try to explore the unknown areas of Graham's Land. Great expectations are held as to the new tractor motor of about 40 horse power, which will be tried in the most difficult ground of Finse for about a week. Commander Worsley states that the expedition intends to start in September if in the meantime it succeeds in getting a vessel suitable for its purpose (about 500 tons gross). He was not sure that Amundsen's ship *Maud,* which is

expected at San Francisco in the summer, was sufficiently large, as the expedition was likely to last a couple of years. It was important to get a vessel of good speed and not necessarily one built for Polar ice, as ice conditions in the seas they would visit, for example, Ross Sea, were not particularly difficult.

NEW ZEALAND is suffering from a serious epidemic of infantile paralysis. All the schools have been closed since Christmas and juvenile travel is only allowed by a permit from the health officers. Over 800 cases of the disease have been reported since the disease broke out in December, with 127 deaths.

UNIVERSITY AND EDUCATIONAL NOTES

AN appraisal filed recently of the estate of Mrs. Anna R. Milton, who died February 15, 1924, shows that Harvard University, as the residuary legatee under the will, receives $765,108. Mrs. Milton stated in her will that the will of her husband provided a trust fund of $1,000,000 for her benefit during her life, and made Harvard the beneficiary upon her death.

PROFESSOR AND MRS. FRANK R. LILLIE have added $30,000 to their recent gift of $60,000 for the new laboratory of experimental zoology at the University of Chicago, construction of which has already begun.

THE State University of Iowa has established the rank of honorary associate which may be awarded to any full professor in a college who is not a candidate for a degree, but wishes to spend a year, a semester or a summer quarter at the university. This appointment carries with it the hospitality of the department with facilities for research, admission to advanced classes and exemption from all fees.

YALE UNIVERSITY announces the appointment of Professor Harold Clyde Bingham, of Wesleyan University, as research associate in the Institute of Psychology, and the appointment of four research assistants, as follows: Helen Heffron Roberts and Alvira A. Kirk, research assistants in anthropology, and Carleton F. Scofield and Donald K. Adams, research assitants in psychology. Dr. Bingham is professor of psychology at Wesleyan, and Miss Roberts and Mr. Scofield are now on appointment in the Institute. Miss Kirk comes to Yale University from the Department of Anthropology of the American Museum of Natural History, New York City, and Mr. Adams from the Psychological Laboratory at Harvard University.

DR. HERBERT FREUNDLICH, of the Kaiser Wilhelm-Institut for Physical and Electrical Chemistry, Berlin, will remain at the University of Minnesota following the third National Colloid Symposium on June 17, 18 and 19, and will offer a special series of lectures during the first half of the summer session of the university. He will present a general survey of the field of colloids with especial emphasis on adsorption phenomena. Coupled with Dr. Freundlich's work will be a group of other offerings, including colloid laboratory work under Dr. L. H. Reyerson, a seminar in colloid chemistry, conducted by Dr. Freundlich, and a series of courses in the division of agricultural biochemistry. These will be: "The chemistry of wheat and wheat products," Dr. C. H. Bailey; "Flour laboratory methods," Dr. Bailey; "Phytochemistry," Dr. R. A. Gortner, and a series of research problems under Drs. Gortner, Bailey, Palmer and Willaman. In all twenty-three allied courses in chemistry, biochemistry and physics will be offered.

DISCUSSION AND CORRESPONDENCE

ON THE DECOMPOSITION OF H_2O_2

IN the August 22nd 1924 issue of SCIENCE there is an article by Dr. Norman E. Ditman in which he states that hydrogen peroxide can be decomposed by a single electrical conductor, one end of which dips in the peroxide while the other end dips into a test tube containing a solution of colloidal platinum. Such a wire does not complete an electric circuit and the results as reported are so contrary to expectation that the experiment was repeated in this laboratory as nearly as could be done from Dr. Ditman's description. Fresh colloidal platinum was made in distilled water, without any stabilizer, by the Bredig method, using a short Pt rod as the positive electrode and a piece of fine Pt wire as the negative electrode. This wire had a total length of about six inches, most of which served merely as a conductor. Only about one fourth inch at one end was allowed to enter the distilled water. It was along this short length that the arcing took place. This end of the wire will therefore be called for convenience the "arced end"—the other end will be called the "unarced end."

The following experiments were then tried:

1. The arced end of the fine Pt wire was put in the beaker containing the colloidal Pt, and the unarced end was put in H_2O_2 of approximately three per cent. strength. No oxygen was given off.

2. The wire was reversed. Bubbles of O_2 formed at once on the arced end of the wire. This effect was unaltered by lifting the unarced end out of the colloidal Pt solution. Arcing had evidently activated the end of the wire.

3. Some of the colloidal Pt was put into the H_2O_2 solution. The colloid was very dilute and the rate of decomposition of the H_2O_2 appeared to be very slow. Nevertheless, tiny bubbles could be seen rising from all parts of the liquid. If, now, the Pt wire was inserted (no connection being made with the beaker of colloidal Pt), large bubbles formed on it, and this was so, no matter whether it was the arced or the unarced end or even the middle of the wire which was lowered into the liquid. The same effect was found using a second piece of Pt which had been previously shown to be inactive. A piece of Pd, a piece of glass tubing and the wood of a piece of lead pencil were also tried with identical results. The formation of bubbles was so vigorous that if the Pt, Pd, glass and wood had not been shown to be, in themselves, inactive, it would have been easy to have concluded that they were more active than the colloidal Pt or the arced end of the Pt wire. The effect was as though considerable of the O_2 resulting from the decomposition was dissolved in the H_2O_2 solution and came out of solution on the surface of the various substances mentioned above.

In view of the unexpected nature of Dr. Ditman's results as given in his article, and in view of the experiments outlined above, it is to be hoped that he may soon publish the results of a repetition of his work in which great precautions are taken to prevent contamination of the H_2O_2 with any agent tending to decompose it. Even light rays should be excluded from the apparatus, and the temperature should be kept low in order to avoid the production of O_2 which may dissolve in the water. In the meantime perhaps we should hold in abeyance any of his conclusions as to "electrical phenomena," "vibrations" and "resonance" of enzymes, zymogens and antitoxines.

WHEELER P. DAVEY

RESEARCH LABORATORY
GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

TERMITES IN BUILDINGS

IN 1894, Dr. C. L. Marlatt, of the Federal Bureau of Entomology, advocated the only effective preventive or remedy against termites or "white ants" in their attacks on buildings and material stored therein. This specific is "insulation" of all untreated woodwork from contact with the ground; it can be accomplished by the use of stone or concrete foundations and lower flooring or the use of foundation timbers impregnated with coal tar creosote. Practically all the termites which damage buildings in the United States are of subterranean habit and if they can be kept from reaching woodwork from the ground they can not survive in the building. Also if present in a building when all untreated wood is removed from contact with the ground, such as joists, wooden floors, sills, etc., even if the termites have penetrated to the third story of the building, they will die out. They have been cut off from their moisture supply in the ground, which is necessary for their life.

Recently the Bureau of Entomology has been advocating the modification of the building regulations of various cities so as to include a few simple rules to prevent attack by these insects. No floors, sills, beams, clapboard, etc., of untreated wood may be laid on or in the earth, and untreated beams must not be laid in concrete without at least one inch of concrete underneath and separating it from the earth. No lime mortar should be used in foundations or in cellar walls where they are in contact with the earth, since termites are able to penetrate lime mortar after some years' service. All brick work extending below the surface of the ground should be faced and capped with concrete at least one inch thick. These slight modifications of the building regulations of cities by city engineers would save much property, time and worry to householders.

The recommendation of the use of heat, steam, insecticides and fumigants against these subterranean termites is of no permanent value and is futile. If conditions in a building are unsuitable to termites they will leave; if they can be prevented from leaving or coming in again by shutting them off from the ground, nothing further need be done and indeed is only a waste of time and money.

Complete insulation of all untreated woodwork from the ground is the only effective method of preventing the ravages of termites in buildings in the United States.

T. E. SNYDER

U. S. BUREAU OF ENTOMOLOGY

EDITORIAL SERVICE

A STATEMENT of the kind of service the editors of the *Physical Review* have been attempting to render authors and readers may be of interest and perhaps call forth suggestions for modification or extension.

SERVICE TO AUTHORS

A manuscript as soon as received is sent to a referee who is competent to criticize the article from a technical scientific standpoint. He is asked to note any possible errors, parts that are not clear, parts that might better be omitted or condensed, etc., and also to give suggestions looking toward the improvement of the article in form. Usually another editor goes through it carefully, particularly from the point of view of form, noting suggestions as to change of English in pencil on the margin. If the

article is acceptable but seems to need revision, it is returned to the author with the suggestions of the referee and of the editor. The nature of these suggestions is indicated by the following samples.

SAMPLE SUGGESTIONS TO AUTHORS

That title be changed so as to be more precise.

That historical introduction be condensed and the results of others be discussed later in comparison with your own.

That description of method used be rewritten according to the following outline, so as to be at once clearer and briefer.

That order of presentation of results be changed. Paper should not be a history of your experiments but a presentation of your results in as clear a form as is possible. Most of section 4 might be omitted and section 5 combined with section 2.

That the mathematics on page 5 be greatly condensed. Most of it seems unnecessary, particularly Eqs. (4), (5) and (7).

Sentence on page 7, second paragraph, is not clear. The statement regarding D's results seems incorrect.

Fig. 1 seems unnecessary. Figs. 5 and 6 might be combined in one. The numbers and lettering on the figures are too small. Fig. 7 should be on blue coordinate paper, not black.

The tables are not in good shape for the printer. Please rearrange more compactly and combine Tables III and IV into a single table.

The editors reserve the right, of course, to refuse any article in whole or in part. Otherwise no attempt is made to dictate to the author. He is distinctly informed that all the suggestions are offered for his consideration to be accepted or not as he thinks best. If he prefers his original order of treatment, his own peculiarities of diction, he is at liberty to keep them. With very few exceptions, however, authors seem to be glad of the suggestions offered and modify the articles in accordance with the suggestions. It is evidently to their advantage that their results be presented clearly and in as readable a form as possible. The scientists who contribute most of the articles are inexperienced authors and moreover have lived with their work so intimately they are often poor judges of how effective their presentation is. To such the impartial suggestions of an expert scientific critic and an experienced reader are recognized to be of value and are thankfully received.

The editor also arranges for any relettering or redrawing of figures that may be advisable and sometimes rearranges parts of a plate to economize space or permit of greater enlargement.

Articles are usually referred to one of the associate editors, of which there are nine, but some have been sent to other physicists who are recognized to be authorities in the subjects involved. These who have refereed two or more articles include K. T. Compton, Saul Dushman, H. E. Ives, A. F. Kovarik, D. C. Miller, A. W. Smith, R. C. Tolman, J. H. Van Vleck and O. F. Zobel. To these and other referees the editors wish to express their appreciation of their generous service.

SERVICE TO READERS

We try to eliminate material that is not new or not reliable or worth publication. We try to insure that authors present their results as clearly and briefly and readably as possible, and that the printing and press-work are good. Each article is preceded by an *abstract,* prepared by the author and carefully revised by the editor, which gives a very complete summary of the subject-matter of the article and of the conclusions reached. These abstracts can be depended upon to be complete; therefore, as shown by a questionnaire (SCIENCE 56, 678, December 15, 1922), many read these abstracts instead of the articles, except in the case of articles which the abstracts show contain results of particular interest to them. An *analytic subject index* to each volume is also provided, which indexes not merely the titles of the articles but all the subject-matter of the abstracts. This index enables all the articles dealing with such a subject as "Photo-electric effect of thin films," or "Scattering of x-rays," to be found immediately.

Finally a word may be said as to some minor matters of editorial policy adopted because of their apparent advantage to readers. In the case of references, the author's name is always given first, so that the footnotes furnish a bibliography independent of the text. We also try to make the captions of figures complete so that any one glancing only at the figures can tell what each is about, except in the case of diagrams intimately associated with a mathematical discussion. The period following a symbol or abbreviation is always an interruption since it suggests the end of a sentence, so periods are eliminated after such symbols as °C, km, cm, mm, cc, ft, gm, kg, lb, kv, μf, but are retained after real abbreviations such as in., amp., sec. Plurals of symbols are indicated before but not after numerical values. *Percent* is not considered to be an abbreviation, and the anglicized expressions *in vacuum* and *abscissas* are preferred. Small letters are used in *a.c., d.c., e.m.f.* The plural of *e.m.f.* is written *e.m.fs.* By analogy with α-rays, β-rays, etc., *x-rays* is spelt with a

small *x*. Like *ampere, angstrom* is spelt with a small *a* and without diacritical mark, but the symbol is *A*. The spelling *disk* is adopted as being more English, and *diaphram* is advocated, and also the use of a hyphen between vowels in such words as *photo-electric*. However, the spellings *tho* and *thru* are considered too different from the accepted forms and too distracting to the reader. We make no claim to consistency; in fact this is foreign to the spirit of the English language. In each case we try to adopt the form which is simpler, clearer and less distracting to most readers; but we can not hope to suit every one. Many will think we go too far, while others will accuse us of being too conservative.

This service to authors and readers requires much careful work, but we hope it is worth the time and effort expended.

GORDON S. FULCHER
Managing Editor of the Physical Review
CORNING, NEW YORK
FEBRUARY 1, 1925

THE FRESH-WATER SPONGE, SPONGILLA LACUSTRIS LINN., IN MASSACHUSETTS

DURING the late summer of 1924 there was found in the Sudbury River, near the village of Concord, Massachusetts, great masses of the fresh-water sponge, Spongilla, growing from a muddy bottom. The occurrence of such large masses of fresh-water sponges is not common, and since this species has not been described from Massachusetts, it seemed desirable to record it.

As one looked into the water the whole river bottom appeared to be covered with many green stalagmitic growths. Upon closer examination, these growths proved to be sponges, averaging about 15 cm in height, the largest reaching a height of about 30 cm. The sponges showed profuse branches of varying diameter tapering at the distal ends. The branching could almost be described as dichotomous. The average diameter of the main stalk was about 8 mm, varying from 3 mm in the shortest specimens to 12 mm in the longest ones. Each stalk was fixed to some river weed, particularly to the fresh-water eel grass, Vallisneria spiralis L., of which there was an abundance. The intense green color of the sponges was found to be caused by the presence of large numbers of green algae living epizoically. By far the greater number of these algae belong to the Protococcales, although there were many diatoms.

The river bottom is extremely muddy, making it impossible to collect the sponges by wading. The current has a low velocity so that the water is clear. The depth of the river at mid-channel varies from 2.5 to 3 meters in the spring, to about 1 meter in late summer. The animals near the banks at this latter season may be bent over horizontally parallel with the surface of the river, while in some cases the water may have receded sufficiently to expose entire colonies.

From the manner of growth and of branching, from the size and appearance of the skeletal and dermal spicules, the species was tentatively identified as Spongilla lacustris Linn. Measurement of 100 skeletal spicules, including all lengths, showed an average length of 0.300 mm (a slightly larger figure than that reported by Potts[1]) and an average diameter of 0.012 mm; while the dermal spicules, exhibiting much less variation, showed an average length of 0.047 mm and an average diameter of 0.0029 mm. The mode for length of skeletal spicule was 0.315 mm, the maximum and minimum lengths being 0.355 mm and 0.285 mm, respectively. It is also to be noted that instead of the swiftly running water habitat, usually reported for this species, these specimens were attached to a deep mud bottom in a slowly moving stream and were supported by water plants.

The approximate location of this habitat is an area of about 280 square meters extending along the bottom of the Sudbury River nearly half way between Nashawtic (Echo) Bridge and the railroad bridge of the Boston and Maine, Southern Division, at Concord, Massachusetts.

Although search was made from August up to the middle of December (long after several severe frosts, and once after the river had been frozen over), no gemmules have been found, preventing a positive identification of the species. Professor Frank Smith, however, who has examined formaldehyde specimens, reports the same tentative identification as given above.

W. H. COLE
D. POTTER
BIOLOGY DEPARTMENT, CLARK UNIVERSITY
WORCESTER, MASSACHUSETTS
DECEMBER 20, 1924

A NATURAL SEISMOGRAPH

A FEW days before the earthquake of February 28th there was rain over the snow-covered fields of Gaspé. This froze into a hard crust. The morning after the earth tremor this crust over the snow fields was found to be cracked in long parallel lines running N.W. to S.E., a little E. This observation is reported to me by Mr. F. J. Richmond, of Gaspé, a close observer, who adds that when snow settles nat-

[1] Edw. Potts. Contributions towards a synopsis of the American forms of fresh-water sponges with descriptions of those named by other authors and from all parts of the world. *Proc. Acad. Nat. Sci.*, Philadelphia, 1887.

urally, cracks in the crust will follow the sags of the ground surface. This automatic register of the movement of the earth-wave indicates a course at right angles to the directions given, namely, N.E. to S.W.

The direction of these crust cracks has been verified, since the above was written, by observations made by lumbermen 40 miles inland from Gaspé.

JOHN M. CLARKE
STATE MUSEUM
ALBANY, NEW YORK

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD OF DEMONSTRATING ACIDITY OF FOOD VACUOLES IN PARAMECIUM

WHILE searching for certain intravitem stains the present writers observed that acidity in the food vacuoles of Paramecium caudatum could very easily be demonstrated in the following manner:

Common red cabbage leaves with the stems cut out were boiled in a minimum of water. There thus was obtained a very dark reddish purple solution which became red in the presence of acids and green in the presence of alkalies. This solution was filtered and a few drops added to a small culture of the infusorian. Within ten minutes the animals had taken enough of the colored fluid and the small particles therein into their bodies to make their food vacuoles very distinct. Under these conditions the food vacuoles appeared distinctly red in color, thus showing the presence of acid in the vacuoles.

This appealed to us as a good simple method for classroom or laboratory demonstration.

ARTHUR N. BRAGG
HAROLD HULPIEU
THE JOHNS HOPKINS UNIVERSITY

MICRO SLIDE RINGS

MICRO slide rings of any size desired can be cut from sheet celluloid by means of hollow punches. These rings are affixed to slides by dipping them in liquid nitrocellulose made by dissolving celluloid in amyl acetate and pressing them down on the slides by means of forceps. When dry, they are permanently attached to the slides, are not soluble in xylol and are excellent for mounting thick objects such as tapeworm proglottids in balsam. Ringing with gold size completes the mount.

Those who have found glass rings unsuitable, who have experienced difficulty in securing fiber or hard rubber rings and who have known the annoyance caused by the hard rubber rings breaking after the mounts are made, will find that this method will solve their problems.

E. C. O'ROKE
SOUTH DAKOTA STATE COLLEGE

SPECIAL ARTICLES

THE EFFECT OF POLARIZED LIGHT ON THE GROWTH OF LUMINOUS BACTERIA

THAT polarized light does have a marked effect on biological phenomena was pointed out for the first time by Miss E. S. Semmens.[1] Shortly after her paper was published, E. G. Bryant,[2] working in South Africa, published a paper on the biochemical effect of polarized light and its relation to some of the superstitions of the natives of his part of the country. Although the presence of sufficient polarized light in moonlight to have any effect on the majority of biological processes is at present disputed by some workers in this field (*cf.* H. M. Fox, Proc. Roy. Soc., B, 95, 523, 1923), Mr. Bryant found that pieces of fish which had been placed in bright moonlight became highly putrid during the course of a night's exposure, while control pieces of the same fish kept in the dark remained comparatively fresh over the same period of time. He offers no explanation for this phenomenon, pointing out merely that the taboo against eating fish which had been exposed to moonlight had a fairly sound basis.

During the course of some work on luminous bacteria, it occurred to me to study the effect of polarized light on the growth and luminescence of these forms. The type used was Photobacterium phosphorescens, isolated from fish obtained at the Princeton fish market in the fall of 1923, and used in this laboratory for various experiments.

Two Petri dishes were planted with these bacteria and one was placed under light which had passed through a Nicol prism, while the other was kept in the dark. At the end of eight hours it was found that the one which had been in the polarized light had reached its maximum intensity, but the one in the dark was just beginning to glow. Likewise, it was found that the first plate had become almost dark at the end of fourteen hours, while the second had just reached its maximum intensity. The normal length of time for a culture to reach its maximum of luminescence and decrease again is about twenty-four hours, and the second plate followed this natural growth rate.

Later experiments were carried out in a more rigorous manner. A Petri dish of agar was inoculated with as uniform a culture of bacteria as it was possible to obtain over the surface of the plate. Two rings of sterile ebonite were then pushed into the agar and the cover of the dish brought down tightly upon them. On top of the plate were placed two ebonite rings of the same diameter as those inside of the dish and directly above them, and the rest of

[1] Semmens, E. S., *Nature*, Vol. III, 49, 1923.

[2] Baly, E. C. C., and Semmens, E. S., Proc. Roy. Soc., pp. 681, 1923.

the plate covered with black paper. In the top of one of these tubes was placed a Nicol prism, while over the opening of the other was laid a piece of cardboard containing a hole of the same dimensions as the prism, in order that the area of the plate which was affected by the ordinary light would be of the same size as that struck by the polarized light. Also over the top of the tube through which the ordinary light was to pass was placed a "neutral wedge" and by means of this the intensity of the light which struck the plate under this tube was brought to the same value as that which impinged upon the plate under the Nicol prism since this latter absorbed an appreciable amount of the incident rays. These two intensities were measured by means of a Macbeth illuminometer. The source of light was a 150 watt bulb of the ordinary gas-filled type, and between it and the plate was placed a bottle through which running water was passing and which acted as a screen to remove the heat radiations from the light.

On a Petri dish which had been prepared in this manner it was possible to have the three conditions under which an experiment was to be carried out all on the same plate; the temperature was uniform over the surface of the plate, and side by side were the areas to be exposed to polarized light, ordinary light and the portions which were to be kept in the dark.

It was found in these latter experiments, as in the case of the former ones, that there was a marked increase in the brightness of that area which had been exposed to polarized light as compared with the rest of the plate. That this was due to an increased rate of growth was determined by the fact that the bacteria had utilized the medium throughout that section of the plate which had been affected by the polarized light, bringing about a diminution of the light over that area even before the other portions of the plate had reached their maximum intensity of luminescence. Inasmuch as there is no method of measuring the intensity of the light of growing bacteria, no quantitative results could be obtained in these experiments, but a conservative estimate of the time required for such a portion of the plate to reach its maximum intensity was one third that of the other parts, whether exposed to ordinary light of the same intensity as that of the polarized light or whether kept in the dark.

During the course of this work some eighteen experiments were performed, of which number fifteen gave positive results, the other three giving results which, while *not* negative, were not of a sufficiently positive nature to warrant them being grouped with the others.

The question arose: Was there any effect of the polarized light on the medium itself? In order to answer this, plates of medium were exposed for about eight hours to light which had passed through a Nicol prism and were then planted with bacteria. Control plates of agar were also made and sown at the same time, but no difference in luminescence could be noted between the two plates.

In view of the fact that there has been practically no work done on the processes which take place inside of a cell upon exposure to polarized light, the cause for this increased growth is a matter of conjecture. However, Miss Semmens's work, which has very recently appeared in a more detailed form,[3] points to an increased rate of the hydrolysis of the starches in the plant. Although there is no starch in the bacterial cell, there are undoubtedly other carbohydrates which may be acted upon in the same manner in which the plant starches are by some of the enzymes present in the cell.

I wish to thank Dr. E. N. Harvey, professor of physiology at Princeton University, for his kind suggestions and interest in this work.

T. F. MORRISON

PRINCETON UNIVERSITY

THE NON-NUCLEATED CELLULAR ELEMENTS OF THE BLOOD[1]

IN a comparative hematological survey probably no one feature is so striking as the contrast between mammals and all other vertebrates with reference to the occurrence of non-nucleated elements in the blood. In lower vertebrates the blood cells are all nucleated; ascending the phylogenetic scale to mammals, we find that by far the major bulk of the circulating cellular elements has been replaced by non-nucleated structures or plastids, as they may be conveniently designated. That the formation, function, quantitative regulation and fate of this predominant mass of non-nucleated material in both health and disease is of fundamental importance can not be questioned.

The history and present status of our conceptions as to the occurrence, nature and origin of these structures may be summarized as follows:

First: That in consequence of the apparently exclusive occurrence of these elements in the mammalian organism, a sharp line of demarkation or hematological discontinuity has been drawn between mammals and all other vertebrates. Indeed, in 1875 Gulliver classified vertebrates into two great groups—the pyrenaemata, in which it was stated that "the blood cells of every animal without any known exception were nucleated," and

[3] Baly, E. C. C., and Semmens, E. S. Proc. Roy. Soc. B, *97*, 250–253, 1924.

[1] Abstract of a paper presented in a symposium on the blood at the fortieth annual session of the American Association of Anatomists, Buffalo, N. Y., 1924.

the apyrenaemata or mammals having non-nucleated elements. Up to the present time, any reported occurrence of non-nucleated structures or plastids in the blood of vertebrates other than mammals has been met with skepticism and their appearance labeled as artifacts or pathological phenomena.

Second: Our interpretations as to the nature of these elements in mammals have diverged fundamentally in two directions: the one (a) accentuating the nucleated nature of all cytological units of the organism has adhered to the proposition that these elements are still nucleated cells which have merely undergone changes obscuring the demonstration of their nuclear components; the other (b) maintains the now dominant conception that these elements can not be correctly designated as other than non-nucleated structures.

Third: Granting their non-nucleated nature, two divergent views again arise as to the origin of these elements: the one (a) involving the detachment and liberation of cytoplasmic segments from the parent cell (as in the case of the blood platelets for example) and the other (b) involving a process of nuclear extrusion (as in the case of the erythrocyte).

In the further consideration of these questions, the present discussion will center around three stages in hematological evolution:

First: The primitive stage in which the cellular elements of the blood both phylogenetically and ontogenetically are at first all nucleated structures.

Second: An intermediate stage common to certain lower vertebrates and the early mammalian embryo in which all the original nucleated types of the preceding stage continue to occur in the circulating blood plus certain non-nucleated structures which are now beginning to appear.

Third: A stage attained only in the older embryonic and adult mammal in which the development of non-nucleated elements has acquired maximum expression and the corresponding parent nucleated cells have disappeared from the circulating blood.

The proposition that both phylogenetically in the lower vertebrates and ontogenetically in the early mammalian embryo, all the cellular elements of the blood are nucleated structures requires no discussion.

Turning then to the second stage in hematological evolution, a stage in which non-nucleated structures first begin to appear, let us direct attention first to the blood in amphibia, a vertebrate group in which respiratory and vascular adaptations have played such a critical rôle phylogenetically, in the transition from an aqueous to a terrestrial environment, and second to a comparison of these amphibian conditions with a corresponding stage in the mammalian embryo.

The cellular elements of the blood in amphibia are generally supposed to consist exclusively of non-nucleated elements. The following résumé of a series of comparative studies[2] show, however, a different state of affairs:

1. In five species of amphibia a type of plastid was demonstrated which consists of a central mass of azur-staining granules surrounded by a peripheral area of hyaline cytoplasm. These elements arise as cytoplasmic segments detached from nucleated cells or thrombocytes having a similar cytoplasmic structure. Since these plastids not only participate in coagulation processes but also appear identical in cytological structure with that of the corresponding elements in mammals, they may be justifiably designated as blood platelets or thromboplastids.

2. A second type of plastid was also found in these five amphibia which in contrast to the platelets consist of large basophilic staining granules and present no peripheral hyaline cytoplasmic area. It can be readily shown that these elements are mast cell derivatives and may consequently be correctly designated as basophilic plastids. Here again the plastids arise through a process of cytoplasmic segmentation from mast cells which may be found at various stages in the liberation of their cytoplasmic products.

The preceding data have been concerned with leucocytic elements. Let us now direct attention to the erythrocyte.

3. In five species of amphibia erythroplastids were found to the extent of from 1 to 5 per cent.

4. Batrachoseps attenuatus, B. pacificus and B. major are amphibians par excellence for erythroplastids, for here 95 to 98 per cent. of the erythrocytes may be non-nucleated. In all these amphibia, both nucleated and non-nucleated elements show great variation in size.

5. That these erythroplastids can not be discredited as degenerative products of little functional utility in an animal in which they may constitute 98 per cent. of the circulating erythrocytes is at once obvious. This is further confirmed by the presence of mitochondria and reticulation in both large and small erythroplastids.

6. That the occurrence of these amphibian erythroplastids is not to be associated with senility or possibly pathological conditions is demonstrated by the occurrence of these elements even in the larval animals.

[2] Emmel, V. E. 1914, "Concerning certain cytological characteristics of the erythroblasts in the pig embryo and the origin of non-nucleated erythrocytes by a process of cytoplasmic constriction." *Am. Jour. Anat.*, Vol. 16, pp. 127–194. 1920, "The erythrocytic and leucocytic elements in the blood of Batrachoseps attenuatus." *Anat. Rec.*, Vol. 18, p. 232. 1921, "Hematological and respiratory conditions in the larval stages of the lungless amphibians, Batrachoseps attenuatus and Anaides lugubris." *Anat. Rec.*, Vol. 21, p. 56. 1924, "The occurrence and genesis of non-nucleated erythrocytes or erythroplastids in vertebrates other than mammals." *Am. Jour. Anat.*, Vol. 33, pp. 347–405. 1924, "Leucoplastids or non-nucleated leucocytic derivatives in vertebrates other than mammals." (In press, *Am. Jour. Anat.*)

7. Finally that neither the leucocytic or erythrocytic plastids can be relegated to the category of artifacts is evidenced by the fact that platelets, basophilic plastids and erythroplastids can be demonstrated in blood vessels carefully fixed *in toto*.

8. Turning now to the question of the origin of these erythroplastids, it can be shown that they arise as segments of hemoglobin containing cytoplasm constricted off from the parent cell. The detached plastids are of variable size, thus accounting in part at least for the variations found in the non-nucleated products. Nucleated remainders are in evidence possessing a variable rim of cytoplasm left after the formation of the plastids.

9. No evidence of either nuclear extrusion or intracellular disintegration of the nucleus in the origin of these elements was obtained. If erythroplastids owe their origin to any cytological mechanism of this nature, positive proof ought certainly to be forthcoming in the large cells of amphibia where such elements have first begun to make their appearance, but the evidence here is entirely negative.

So far in the consideration of this second stage in hematological evolution we have been dealing with conditions in lower vertebrates. Let us now turn to corresponding stages in the mammalian embryo.

10. *In toto* mounts of fixed blood vessels of the pig embryo at a period in which the transition from nucleated to non-nucleated elements is making its appearance, it can be shown that here again the erythroplastids arise as cytoplasmic segments detached from the nucleated cell. Just as in amphibia here also the erythroplastids show great variation in size and the nucleated remainders possess a variable rim of cytoplasm.

11. This evidence from fixed embryonic blood vessels is confirmed by a series of consecutive observations on tissue culture preparations of living nucleated erythrocytes in which the mature erythroblasts were seen to undergo a process of cytoplasmic subdivision resulting in the formation of typical non-nucleated erythrocytes.[3]

12. Consequently, it will be observed that point for point the genesis of erythroplastids in amphibia and mammalian embryo coincide to a remarkable degree. The fact that in its most complete expression the process of erythroplastid formation in the adult mammal may involve a reduction in the cytoplasm associated with the nucleated remainder to such a small minimum as to closely simulate the extrusion of a naked nucleus, appears largely responsible for the prominence which the conception of nuclear extrusion has come to occupy in our hematological literature. It is only upon acquaintance with the behavior of the large erythrocytic cells of the mammalian embryo and of the amphibian that the fundamental nature of the process becomes most clearly evident.

The third stage in hematological evolution has been attained only in the late embryonic and adult mammalian organism. Here, as is well known, erythroplastids and blood platelets, both quantitatively and numerically, dominate. In contrast to the preceding stages, the parent nucleated progenitors of these elements are no longer present; they have now disappeared from the blood stream and become localized in regions obviously more favorable for their proliferation and the elaboration of their specific products. From these local regions through the agency of segments of cytoplasm liberated into the blood stream they continue their original functional rôle in the circulating blood.

It is not without interest here to also note that there is cumulative data in the more recent investigations indicating that lymphocytes and possibly even mast cells also evidence a tendency through cytoplasmic segmentation to give rise to corresponding plastids in the connective tissue spaces and lymphatic channels, but that these plastids do not persist and appear to go into solution before or upon entering the systemic circulation.

In résumé the objectives of the present paper have been:

First: To stress the fact of the occurrence of non-nucleated elements in the blood of vertebrates other than mammals.

Second: To show that a sharp hematological discontinuity between mammals and other vertebrates in this respect is consequently no longer tenable.

Third: To emphasize the origin of these elements as segments of cytoplasm detached from leucocytic and erythrocytic cells.

Fourth: That this process of cytoplasmic segmentation furnishes a mechanism of fundamental significance in an adaptation whereby in the course of hematological evolution from the lower vertebrates to mammals, nucleated blood cells may become localized in extra vascular regions and still maintain their original functional rôle through the agency of segments of cytoplasm liberated into the circulating blood.

The conception that segments of cytoplasm may become detached from nucleated cells and persist as intact definitive non-nucleated elements in the circulating blood has been slow to find recognition. The fundamental tenet that the unit of living matter is the nucleated cell is naturally conducive to conservatism in the recognition of such a process. In spite of the overwhelming evidence, for example, of the megakaryocytic origin of blood platelets, we still find a persistent reiteration of the view that these elements are independent living structures without derivation from any known blood cells. Indeed Perroncito[4] has recently voiced an apparent undercurrent in this opposition with the statement that "it is superfluous to say that the theoretical importance of this teaching goes beyond any hematological research and the

[3] Emmel, '14, *loc. cit.*

[4] Perroncito, A., 1920, "On the origin of platelets from megakaryocytes," Hematalogia, Vol. 1, p. 111.

question of the origin of platelets; it faces our fundamental modern conceptions of the problems of life. We do not find, as far as I know, in all our knowledge of biology a phenomenon which may be compared to the derivation of platelets from megakaryocytes. In all the history of the human body, we do not find any cellular elements from which parts of protoplasm detach themselves and form another category of elements with a deeply different, well-defined, morphological individuality as in the case of platelets and megakaryocytes."

Obviously a question of this character must eventually be settled by facts rather than by preconceived ideas or opinions. On the basis of the data just elaborated, we appear obliged to recognize the necessity of a modification of our previous conceptions of the nature and origin of the non-nucleated elements of the blood.

VICTOR E. EMMEL
COLLEGE OF MEDICINE
UNIVERSITY OF ILLINOIS

THE ILLINOIS STATE ACADEMY OF SCIENCE

THE eighteenth annual meeting, held at Springfield, Illinois, February 20 and 21, 1925, was one of the best in the history of the academy. It was well attended, both by members and by citizens of Springfield, and the many and varied papers were much appreciated.

On Friday, February 20, there were three general sessions and two business meetings, and Saturday forenoon the following section meetings were held: biology and agriculture, chemistry and physics, geography and geology, medicine and public health, psychology and education, and a high school section. There were eighty-three papers given in the two-day program.

Saturday noon the academy joined the Mid-Day Club of Springfield for luncheon, at the close of which President Burton, of the University of Chicago, gave an interesting address on "The place of research in modern life." Trips were planned for Saturday afternoon by the local committee to points of interest about Springfield, among them being visits to a coal mine, to Lincoln's Tomb, and to the following laboratories: The State Department of Health, the State Highway Department and St. John's Hospital.

The following officers were elected for the coming year:

President: Dr. Stuart Weller, University of Chicago.
First Vice-president: Mrs. Eleanor C. Smith, Englewood High School, Chicago.
Secretary: Professor C. Frank Phipps, State Teachers College, DeKalb.
Treasurer: Dr. W. B. McDougall, University of Illinois.
Librarian: Dr. A. R. Crook, Chief, State Museum, Springfield.

The academy now has 551 members, and there are affiliated with it thirteen independent scientific societies of the state and several high school science clubs.

C. FRANK PHIPPS
Secretary
DEKALB, ILLINOIS

THE OKLAHOMA ACADEMY OF SCIENCE

THE thirteenth annual meeting of the Oklahoma Academy of Science was held in Norman at the University of Oklahoma on February 14, 1925, under the presidency of C. E. Sanborn, of Stillwater. The academy met in three sections. The following papers were presented:

BIOLOGY SECTION

The effect of secretin on the secretion of the pancreas, kidney and submaxillary glands: ALMA J. NEILL and LESTER L. FRITZ.

The effect of thyroparathyroidectomy on body activities: HOMER L. BRYANT.

The action of lobelin upon the circulatory organs: GERTRUDE NEILSEN.

Adaptions in caudal musculature: RUTH HOLZAPFEL.

Definitive sex cells of the chick: HAROLD HULPIEU.

Further notes on the oviposition for Bruchus, and the orientation of the embryo in the egg during development: ALFRED BRAUER.

A dipterous parasite of the tomato worm moth—Protoparce quinquemaculatus: HAROLD M. HEFLEY, Jr.

A Cylindrotaenia from Bufo woodhousii: VAN A. JOSEPH.

Notes on the reptiles and amphibians of Okmulgee County, Oklahoma: EDITH R. FORCE.

Preliminary list of snakes of Oklahoma: A. I. ORTENBURGER.

Ecological succession in the Arbuckle region: A. F. SHULTZ.

Distribution of spiders as correlated with environmental factors: VERA G. SMITH and D. YOUNG.

The biome as an ecological unit: A. O. WEESE.

Oklahoma climagraphs and biotic regions: A. O. WEESE.

The supertidal animal community in the Puget Sound Region: A. O. WEESE.

The genetic factors of growth with especial reference to Cucurbit's crosses: ORVILLE C. SHULTZ.

Linkage relations: W. A. CRAFT.

Notes on the Oklahoma species of Onthophagus: W. J. BROWN.

Evidence of increase in certain rare species of birds in Oklahoma: R. O. WHITENTON.

Some materials used in nest construction by certain birds of the Oklahoma panhandle: R. C. TATE.

Some bird observations in Cleveland County in 1924: MARGARET M. NICE and L. B. NICE.

Notes on migratory birds in Oklahoma: D. W. OHERN.

CHEMISTRY-PHYSICS SECTION

(This section met in joint session with the Oklahoma Branch of the American Chemical Society. Papers were presented by members of both organizations.)

The analysis of some proprietary remedies used in the treatment of animal distemper: GUY Y. WILLIAMS.

Beet and cane blackstrap molasses as a source of vitamine: V. G. HELLER.

Theory and operation of the "Dodge design" rheostat: H. L. DODGE.

Chemists in Oklahoma: O. M. SMITH.

Extent and applicability of unit coal: JOE E. MOOSE.

The measurement of small capacities by the condensers-in-parallel method: WILLIAM SCHRIEVER.

On the theory of the photo-electric effect: J. RUD NIELSON.

Some interesting Oklahoma minerals: A. C. SHEAD.

A theorem on the energy dissipation in branched electric circuits: J. RUD NIELSON.

Preliminary report on space charge in electrolytes: D. E. ROLLER.

Theory and practice of application of oil to roads: F. W. PADGETT.

An inexpensive electric hot plate: SYLVAN WOOD.

The trend of radio development: J. C. KOSITZKY.

Color tests: I. H. GODLOVE.

GEOLOGY SECTION

A preliminary division of Oklahoma into provinces and districts on the basis of rainfall adequacy: C. J. BOLLINGER.

The eastern boundary of the Great Plains in North Central Oklahoma: C. J. BOLLINGER.

Some stalactitic forms of Marcasite: H. C. GEORGE.

Lateral migration of North Fork of Red River: A. J. WILLIAMS.

Preliminary report on the Comanchean of Northwestern Oklahoma: R. L. CLIFTON.

The occurrence of Caliche in Oklahoma: JOHN T. LONSDALE.

Unsolved geological problems in Oklahoma in 1925: CHARLES N. GOULD.

Oklahoma's rank in the United States in the value of new wealth: CHARLES N. GOULD.

Geology and oil fields of the Mid-Continent Area: CHARLES N. GOULD.

Finding of celestite in Oklahoma: CHARLES N. GOULD.

Lichens as weathering agents of limestone: S. WEIDMAN.

Some processes in the formation of the stream valleys of Oklahoma: O. F. EVANS.

Correlation of Whitehorse sandstone: R. L. CLIFTON.

GENERAL SESSION

A scientific study of cross-word puzzle vocabularies: M. R. CHANCEY.

Testing a true-false test: GEORGE F. MILLER.

Formulas for scoring mental tests in which the maximum amount of chance is known: GEORGE F. MILLER.

At the annual dinner the president delivered his address upon "National conservation from a biological standpoint." President J. S. Buchanan, of the University of Oklahoma, Professor F. W. Padgett, president of the Oklahoma Branch of the American Chemical Society, and Dr. Archibald Henderson, of the University of North Carolina, also gave brief addresses. Moving picture reels were exhibited, showing the habits of the sea horse, the salmon industry and the heat treatment of steel.

At its annual business meeting provision was made for a reorganization of the academy, based upon four sections: Biology, geology, chemistry-physics and social sciences. This reorganization involving a reconstituting of the officers and executive council, a committee on constitutional changes was ordered to work out the necessary changes and revisions so that at the meeting to be held at Thanksgiving, 1925, the new plan may be put in full operation.

Resolutions were passed requesting the State Board of Education to adopt, in addition to its present criteria of accrediting high schools, a quality standard by which schools will be graded upon the preparation of the teachers of special subjects.

Thirty-eight new members were elected.

Officers elected for the coming year are: *President,* H. L. Dodge; *vice-presidents,* L. B. Nice and C. N. Gould; *secretary,* A. Richards; *treasurer,* F. G. Brooks; *curator,* J. H. Cloud.

A. RICHARDS
Secretary

UNIVERSITY OF OKLAHOMA,
NORMAN, OKLA.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORT OF THE COMMITTEE ON THE PHILOLOGICAL SCIENCES

GENERAL AIMS

THE chief work of the special committee on Philological Sciences in the Association has been carried on during the past two years in the interest of a closer cooperation between those philologists whose methods and aims are scientific and other groups of scientific workers, in order that the study of language and related subjects may as instrumentalities of culture be better harmonized with our modern scientific ideals and educational methods. The committee has found that a number of the older and more seasoned scholars in the various societies devoted to philological

studies are convinced of the advisability of such cooperation; but they also find that these organizations contain many members whose interests are especially literary and pedagogic and who, for one reason or another, do not wish that the traditional literary classifications of these subjects be disturbed. The committee has therefore relied chiefly upon the philological membership of Section L of the association to carry on its work. This group of association members is steadily growing in numbers and now contains some 80 persons who expressly profess themselves as interested in philological studies. The recent Washington meeting of the section was evidence of the high scholarship and enthusiasm of this membership.

RESEARCH PROJECTS

The committee has also attempted to take steps toward the organization of scientific research in philology with a view to the cooperation they have been seeking. The Cincinnati meeting therefore took the form of a conference on philological research. Almost a score of different projects were there presented, several of them involving the expenditure of millions of dollars. The committee deemed it wise to select for recommendation those projects which were most urgent, were well within the possible resources available and would be of the most practical value to the largest number of students of language. They were unanimous upon two which met these conditions, (1) a project for a new edition of DuCange's Dictionarium of Medieval Latin, and (2) a project for the establishment of a National Phonetic Laboratory. The former of these has received the endorsement of various learned societies. The latter, *viz.*, a National Laboratory for Phonetic Research, is a new project and one of great importance to science, in view of the fact that the new scientific knowledge which the perfecting of instruments of precision for acoustic measurements and the present activity prevailing in the field of acoustic physics are now bringing to light will have the effect of changing our current conceptions of the fundamental aspects of all language phenomena.

The committee is therefore unanimous in recommending to the attention of the council of the association the importance of making these new resources and their new data accessible to trained phoneticians and psychologists as well as to physicists, so that the two groups of investigators shall work hand in hand, each supplementing the work of the other. Thus this new knowledge may be brought to bear not only upon the improvement of methods of speech transmission, but also upon the improvement of methods of education as they affect this, the most vital function of our intellectual development. The new precision instruments for acoustic measurement are too expensive for college and university laboratories to purchase and require expert mechanicians to operate them. They are now accessible, and at great inconvenience, only in the commercial research laboratories. The proponent of this project, Dr. Knight Dunlap, of Johns Hopkins University, recommends a National Laboratory of Phonetics, centrally located, fully equipped with the most modern instruments of physical measurement, and under the control of a director and resident staff. The committee on philological sciences thinks the same or better results could be secured at less expense by associating this laboratory with the United States Bureau of Standards, which is already fully equipped with the most efficient instruments for acoustic investigation and manned by a competent resident staff to operate them. Such a coordination, if feasible, would save the expense of duplicating the more expensive instruments, and the salaries of resident director and staff. Indeed the Bureau of Standards, in accordance with its normal functions as a federal agency, is already working upon problems of speech acoustics in connection with industrial organizations. If the question of determining physically the standards of American speech as a basis for a more scientific system of language training in our high schools and colleges could be regarded as of equal importance with the improvement of the telephone, radio-telephone transmission and the phonographic reproduction of speech, this whole problem of bringing the recent progress in acoustic science to bear upon phonetics would take care of itself without much additional expense.

RECOMMENDATIONS

The Committee on the Philological Sciences in the American Association for the Advancement of Science would recommend that its work be continued substantially as at present, the special committee being perhaps reorganized so that its membership will be still more representative of the scientific aspects of linguistic science throughout America.

The committee would also express its deep appreciation of the sympathy and patience with which the executive officials of the association have aided them in their work. Indeed, the most encouraging sign that Renaissance conceptions of these studies and of their relation to education are at last giving place to attitudes of mind that accord with the advance of science as a whole is to be found in the cordial cooperation of men of science in the efforts which the committee has been making.

W. A. OLDFATHER, *Chairman*,
The Committee on the Philological Sciences